SCIENTIFIC AMERICAN

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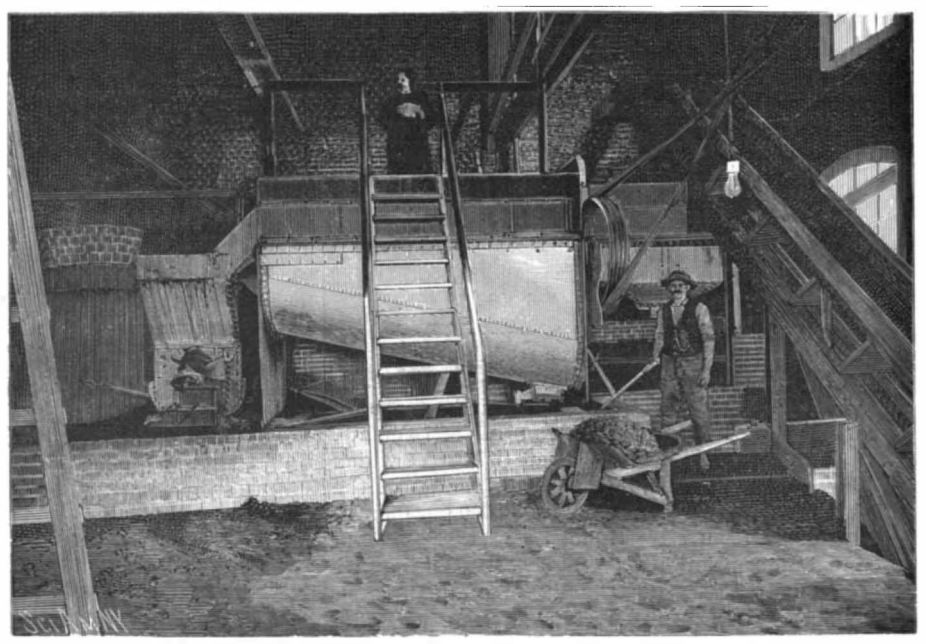
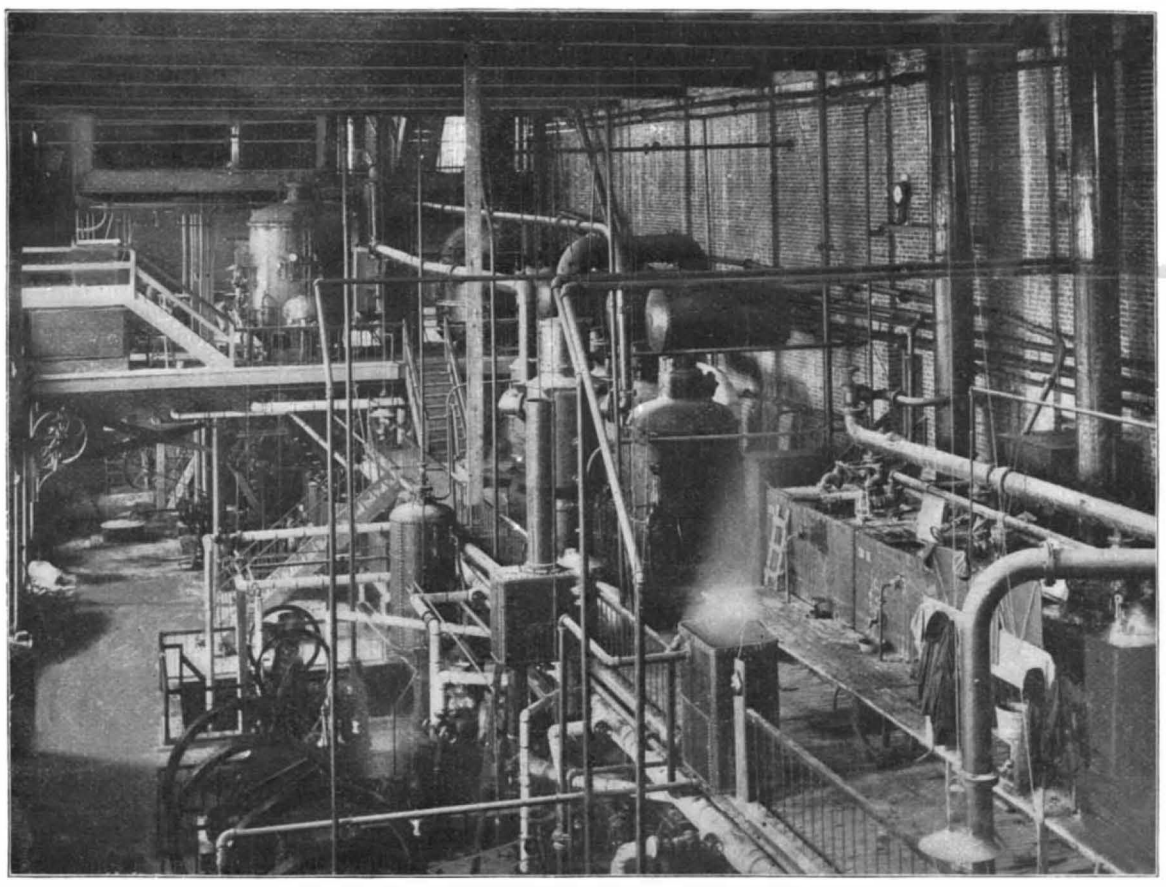
Harvesting the Beets.

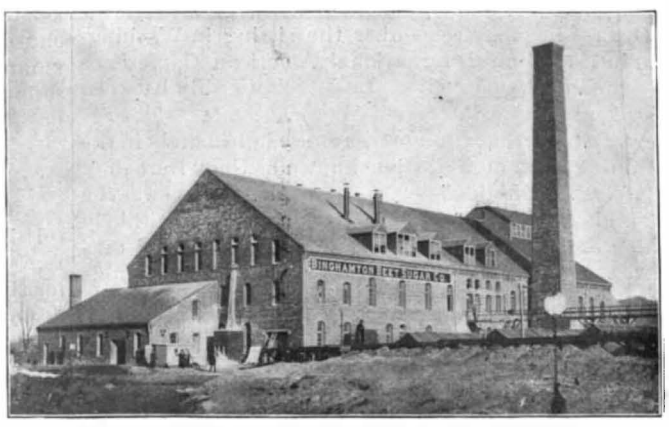


The Machine that Completes the Washing of the Beets.

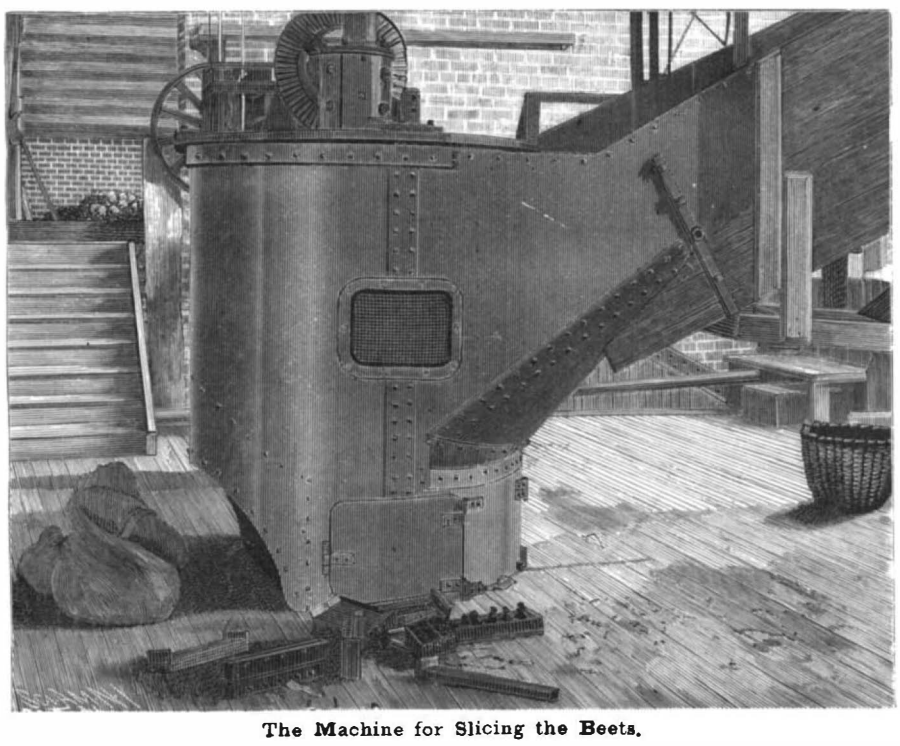


General View of Apparatus for Evaporating the Juice.

Putting the Beets into Sluice of Hot Water to Wash.



General View of the Exterior of the Building.



The Machine for Slicing the Beets.

The Diffusion Cells, where the Sugar is Soaked Out.

THE MANUFACTURE OF BEET SUGAR AS CONDUCTED IN NEW YORK STATE.—[See page 36.]

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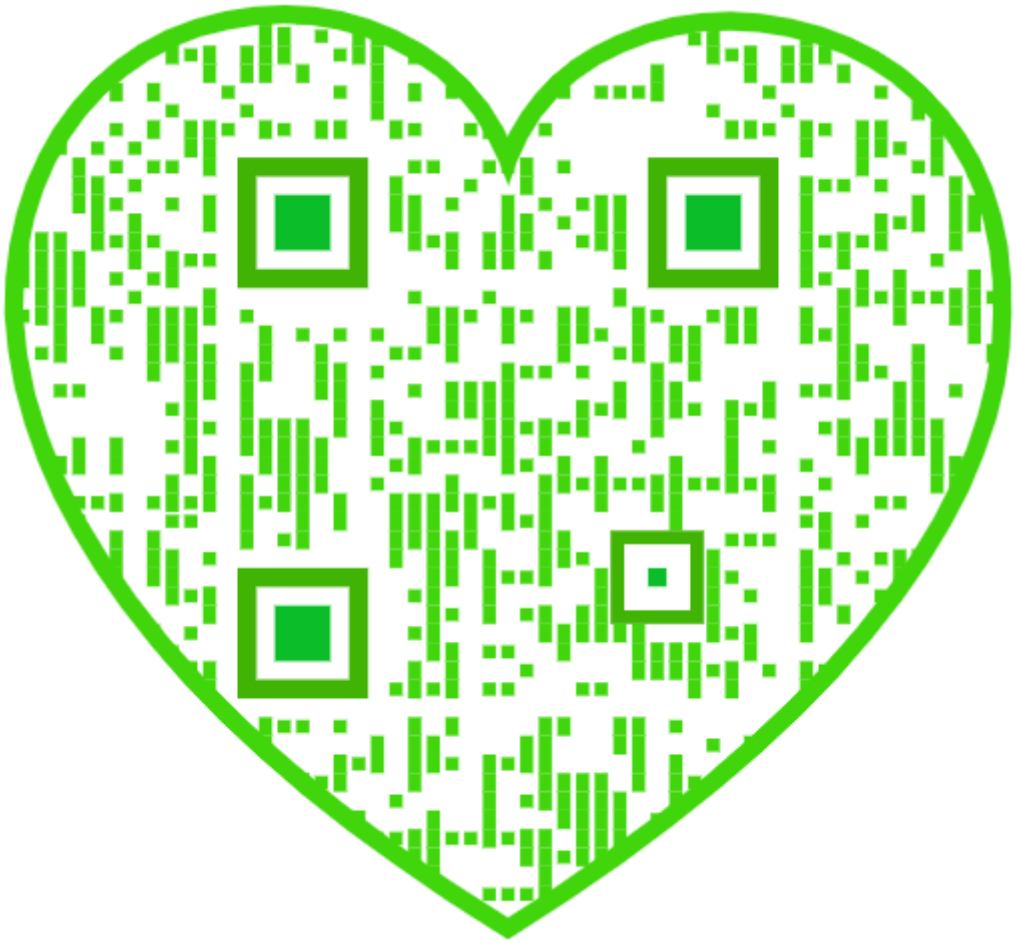

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NEW YORK, SATURDAY, JANUARY 21, 1899.

SHALL THE GOVERNMENT ENGAGE IN COMMERCIAL ENTERPRISES?

"Director Emory, of the Bureau of American Republics, in his annual report, shows on December 1, 1898, a balance of $16,569 out of the annual appropriation of $36,000. The receipts from advertisements, etc., from July 1 to November 30 were $17,812, of which $16,078 was expended. When he took charge of the bulletin, it was published at a cost of $8,000 per month; the net income from advertisements was $36,000, and the annual appropriation was $28,000. By doing away with the advertising system then in force and making other changes Mr. Emory effected a saving of $5,000 per month."

Anyone casually reading the above in the daily press would naturally suppose that it referred to the business affairs of some private publishing concern. As a matter of fact, astonishing as it may seem, it refers to the annual report of a United States Government Bureau, whose operations constitute one of the most flagrant abuses of the functions of national government on record.

In times like the present, when the elements of political economy are familiar to the average schoolboy before he is far advanced in his teens, it should seem superfluous to discuss in the columns of a journal the question whether it is lawful for a government to engage in business enterprises which bring it into direct competition with the commercial interests of its own citizens. Yet this is exactly the situation in which the United States government stands to-day in respect of the bureau whose report Director Emory has just made public.

Our readers may remember the sitting in Washington in 1890 of an International American Conference designed to promote closer trade relationship between this country and the South American states. The deliberations of that conference resulted ultimately in the founding of an organization known as the "Bureau of American Republics," whose ostensible purpose was the disseminating of special information of the kind likely to increase the trade between those countries and ourselves. Appropriations were granted, and the funds thus available were expended in the printing and dessemination of a varied assortment of literature directed to the attainment of the desired result.

So far, so good. The object was laudable and the methods legitimate and unobjectionable.

In course of time, however, it seems to have occurred to the bureau that the increasing circulation of the monthly bulletin rendered it at once an alluring medium to the advertiser and a possible mine of wealth to the bureau; and forthwith, without one thought of the gross violation of principles involved, an army of government advertising agents was sent out, together with a large volume of franked literature, soliciting paid advertisements from merchants all over the country.

Finding itself fairly launched as a commercial advertiser, and with such gratifying pecuniary results, the bureau cast about for other money-making devices, and hit upon the happy idea of publishing a directory of reliable manufacturers, etc., in the United States. With admirable simplicity and singleness of purpose, it decided that the sole test of a firm's fitness to figure in the directory as "reliable" should be its willingness to enrich the exchequer of the bureau to the extent of five dollars for each insertion. This method of contribution proved to be as remunerative as it was original, for it is certain that if private methods of this character are so frequently successful in wringing the unwilling cash from the victim, few firms would be willing to endanger their commercial reputation by exclusion from a Government Directory, especially when such august indorsement could be obtained by the expenditure of a paltry five dollars!

We will be charitable enough to believe, however, that it is thoughtlessness or simple ignorance that has allowed the bureau to be guilty of such an extraordinary misdirection of its own powers, such a complete misinterpretation of the proper functions of national government. If, by virtue of the advantages of its public appropriations and franked correspondence, the government is entitled to set up successfully in the publishing and advertising business, why should it not also set about making bicycles, hats, baby carriages, or agricultural implements. The government has just as much right to set up a brewery or a sugar refinery, and run it with all the backing that comes from national appropriations and franked correspondence, as it has to insert paid advertisements in its publications, or start commercial directories at the rate of five dollars an insertion.

While the operations of this bureau fully deserve all the odium which they have incurred on the part of the commercial interests which have been so unjustly assailed, this element of the question is less serious than the fact that a door is hereby opened for further and more flagrant abuses. A precedent has been established, which, unless it be stopped and emphatically repudiated, cannot but lead to similar abuses on a more extended scale. It is the duty of the people of the United States to check at the very outset a system which is thoroughly pernicious in itself, and fatally subversive of the interests of sound government.

THE DIAMOND REEF SHOAL IN NEW YORK HARBOR.

There is no question that the battleship "Massachusetts" grounded, not, as was at first suggested, upon a sunken wreck, but upon a dangerous reef of sand off Governor's Island which is a serious menace to the safety of all the deep draught warships that have occasion to go to the Brooklyn navy yard. An examination of the plating of the keel when the ship was first placed in dry dock gave ample proof that it was not the irregular and unyielding form of a wreck or sunken rock that did the mischief. Had it been either of these, the plating would have been torn and the frames cut through; whereas, the frames were in the main not distorted, while the plating between them was bent or dished in just as it would be if some plastic material were forced against it with great pressure; in fact, the ribs and the keel framing stood out in relief through the skin plating just like the ribs of a greyhound. The result is just such as would be caused by the enormous pressure of the sand as the great ship pushed itself bodily through the reef.

The Secretary of the Navy has recommended the immediate deepening of the channel, and we think there can be no question of the great urgency of the situation. As matters now stand any one of our first-class battleships which draw well on toward 27 feet of water is liable to suffer injuries equal to those of the "Massachusetts," which have entailed dry-docking and two months' detention at the yard for repairs. This is a serious state of affairs at any time and might prove positively disastrous in time of war.

A GREATLY NEEDED AMENDMENT TO THE PATENT LAWS.

It is a curious fact that at this late day the Patent Laws of the United States should contain no provision for the event of an inventor or applicant for a patent becoming insane before the patent is granted. As the matter now stands, the inventor who becomes insane is entirely at the mercy of his affliction as far as the interests of his invention are concerned.

We are glad to see that a bill has passed the House of Representatives and has been introduced into the Senate in which it is provided that "when any person having made any new invention or discovery for which a patent might have been granted becomes insane before a patent is granted, the right of applying for and obtaining the patent shall devolve on his legally appointed guardian." The law is to apply to all applications at present on file in the Patent Office.

The obvious necessity and justice of this amendment will commend it, we doubt not, to the unanimous approval of the Senate and the Executive. It is only remarkable that the omission of such a provision from the statutes was not rectified long ago.

THE DISEASES OF NATIONS.

Looked at from more points of view than one, the nation has many of the characteristics of the individual. In periods of international unrest, when rumors of war, or, as in the case of the United States, its stern realities, are upon us, the great aggregation of elements known as a nation takes on an even more distinct individuality than usual, and presents itself to the mind in the form of some representative and clearly defined personality.

While the recognition of the fact that a nation possesses many of the characteristics of an individual organism is most pronounced, perhaps, during the fever and madness of war, we do, at all times, unconsciously but habitually speak of nations as possessing and exercising the functions of the individual. Nations are "born" amid the throes of a revolution; "nursed" through their childhood and youth; "come of age" and grow to full manhood; have "offspring" in the shape of colonies, which are nourished, neglected, or abused, as the case may be, by a "mother country." Nations, moreover, have their "prime," their "decline," their "diseases," and "death," and it is only a few months since the term "dying nations," spoken by a leading statesman, was accepted by the world as aptly describing the condition of some of the oldest races of the world.

An extremely interesting study of one phase of this subject is afforded by a lecture recently delivered in Philadelphia before the Society of Ethical Research by Dr. Daniel G. Brinton, of the University of Pennsylvania, in which it was shown that one of the most striking evidences of what might be called the organic life of nations was the fact that, like the individual, they are subject to specific diseases, which undermine their strength, sap their vitality, and, in time, if not restrained, bring on senilty, decay, and even death itself.

Some fifty years ago a French officer, after careful study of history, determined that the natural term of life of a nation was between eight hundred and one thousand years. Dr. Brinton, however, entertains the belief that a nation, if it is thoroughly conscious of what it is doing, and is not crushed by some of those deadly blows which seem to be of fate, may so guard against national diseases as to insure to itself a life indefinitely prolonged.

A nation is defined as being diseased "when, as a unit, it is chronically incapable of directing its activities toward self-preservation." National diseases are not necessarily of the majority of the nation. In the human system one organ may fail us and precipitate an untimely death; so in nations. A degenerate aristocracy, a dissolute priesthood, or a corrupt government has led to the undoing of a nation, the majority of whom have been free from national disease. The diseases that destroy nations are not so much of the individual, but of the national life.

National diseases may be classified under four heads: 1, imperfect nutrition; 2, poisons; 3, mental shock; and 4, sexual subversion. Some physicians trace all disease in the human body indirectly to insufficient or misdirected nutrition in one of the organs of the body. The historian Buckle said that "the history of every nation could be traced by the food it was accustomed to eat." The expression was too sweeping, yet it was based upon truth. "Every nation must have, throughout all the nation, enough to eat, of good quality, and properly prepared; or that nation will degenerate."

There is a scarcely a nation in Europe which produces enough food for its own consumption. They all know that the foundation of disease—starvation—will be their most terrible enemy in a time of general warfare, and this consideration helps to bind them to an unwilling peace. Starvation or insufficient and improper supply of food brings about degeneration of tissue, inferiority of stature, and a general weakening of the body.

The peasants of Northern Italy present aspects of degeneration, due to their eating the maize (as they frequently do) when it is subject to a local blight. The Jews of Europe are two to three inches underneath the stature of the nations among whom they have lived since the middle ages, the cause being unquestionably the limited and inferior food supply which has been their lot. So with the Lapps of the North and the Bushmen of Australia.

Poisons is the name by which Dr. Brinton specifies the second class of diseases. Among these he includes and gives first mention to alcohol and tobacco. While they may be harmless if used in moderation, the using of them, as it is now customary in most nations—and those nations often among the most civilized—brings with it the elements of national degeneration and decay. The lecturer, in making this statement, admitted that he himself used these commodities in moderation, and therefore was able to designate them as poisons without a suspicion of adverse prejudice on his part. "These are poisons which we deliberately and intentionally take into ourselves," but there are other poisons, such as malaria, distinctly influencing national power, which up to the present time medical science has not been able to meet. There are vast areas of the earth afflicted with malaria, where, as far as we can at present see, it will be impossible for any nation to survive and prosper. There are, moreover, certain infectious diseases, such as leprosy, which, while they are purely physical diseases, are national in their character. They influence the history of the nation, destroy its power, and shorten its life.

The third form of disease is that peculiar physical effect which medical men call "shock." Surgical operations which, under ordinary conditions, should be successful sometimes imperil, if they do not destroy life, because certain mental temperaments receive what is known as "surgical shock." Something answering very closely to this is discernible in the history of nations. Under its influence they appear to lose control of their faculties, yield to despair, and suffer a complete

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collapse. An instance of this is found in the conquest of Mexico by a handful of Spaniards under Cortez, another in the exploits of Pizarro in Peru, in both of which cases the powerful native races seem to have suddenly lost all sense of their own power and resources and suffered a mental collapse that corresponds very closely to the shock known in surgery.

The fourth element of disease is sexual subversion, which Dr. Brinton regards as "probably the most insidious, prolonged, and dangerous of all the causes of national disease." Under this head he specifies the failure of population to increase, owing to the fact that marriage either does not take place or is, for various reasons, infertile. Statistics prove that, if the population is to grow, independently of immigration, there should be an average increase of four children to each family, even if all members of the population should marry. This is necessary to compensate for the natural losses; for infant mortality carries off one-fourth of the population, while the early death of the parents or unfruitful marriages serve to prevent the increase of population and reduce the average number of births per family below the number necessary to merely keep the population at a constant number.

In addition to these, the principal causes of national disease, are various diseases that affect the mind of the nation, such as imbecility, seen in many lower tribes like the native Australians. Incapable of following out a logical argument, they cannot understand civilization, and die out when they come in contact with it. Criminality, which is defined as a disposition in any man to destroy the social fabric around him for selfish aims, is a disease which has sapped the life of nations, and national delusions is another. The crusades were an exhibition of what might be called epidemic hysteria, and in what is called Jingoism, or by the French Chauvinism, we see evidence of an inordinate mental exaltation which leads to a national disease of the emotions that may prove to-day, as it often has in the past, very fatal.

Dr. Brinton's lecture, which should be read in its entirety, will be found in full in the current issue of the SUPPLEMENT.

DILIGENCE REQUIRED FROM THE OWNERS OF TRADE-MARKS.

The decision of the United States Circuit Court of Appeals for the Second Circuit, in the action brought by Emile Saxlehner against The Eisner & Mendelson Company, handed down on the 5th instant, is a timely warning to the owners of valuable trade-marks and trade-names to be diligent, not only in securing their rights in the first instance, but in vigorously protecting them from invasion thereafter.

The action was brought by the proprietor of the well known Hungarian bitter water, "Hunyadi Janos," to enjoin the defendant, a wholesale drug establishment, from selling similar waters under the names "Hunyadi Matyas" and "Hunyadi Laszlo," and also to enjoin it from using a red and blue label, closely simulating that used by the complainant.

On the trial of the case, it was shown that from about 1888 until the commencement of the suit in 1897 many thousand cases of Hungarian bitter water, under the names "Hunyadi Arpad," "Hunyadi Matyas," "Hunyadi Laszlo," and under other similar names, had been sold in the United States under similar red and blue labels without protest, objection, or action of any sort by the complainant or its predecessor in interest; and Judge Shipman, before whom the case was tried in the Circuit Court, decided in June last that the defendant was entitled to use the word "Hunyadi," but enjoined the use of the red and blue labels (88 Fed. 61).

Both parties appealed from this decision, and the Court of Appeals now holds that the exclusive right to use the red and blue labels, as well as to the name "Hunyadi," had been abandoned and lost by the complainant in this country.

The opinion was written by Judge Lacombe, who, after reviewing the facts, says:

"In view of these facts, of the continued and increasing appropriation by competitors of his label and of his trade name as a general designation, can a complainant who has for nine years done nothing toward maintaining or even asserting his original rights now be heard to suppress the competition which his supineness has allowed, and, indeed, invited and encouraged, to grow up? We think not. The case at bar seems to be one of those exceptional ones referred to in Menendez vs. Holt (128 U. S. 514), where delay or acquiescence has been continued so long, and under such circumstances, as to defeat the right of possession."

REPAIRING THE LIGHTNING ROD OF ST. PETER'S AT ROME.

It may not be generally known that the basilica of St. Peters, at Rome, has a lightning rod. Some two years ago, when repairs were in progress on the great ball of the cupola, the director of the Leonine Observatory made use of the scaffold which had been erected to measure the point of the lightning rod. He saw that the metallic cable was not continuous and it was not connected with all the metallic parts of the building; consequently it was worse than useless. He then gave orders to have the point of the rod changed for a multiple formed like a flame. He found that the rod ended in a hole filled with tallow and grease. This made the rod positively dangerous. He therefore reset the end of the rod and replaced the tallow by graphite, which is a good conductor of electricity. A special scaffold was erected on the dome, and the lightning rod was made continuous.

EDIBLE WEEDS.

A collection of weeds that would be classed as pests and agricultural nuisances in this country would be considered by many of the people of Europe as excellent "greens" and salad plants. Down on the meadows thrive vegetable growths that would prove of dietary value to us, if we but knew of their virtues; up in the woodlands or on the hillside, other so-called weeds spread in such amazing rapidity that the farmer stands aghast at the bare idea of exterminating them, although in truth the wild growths are really vegetables of considerable value to man and beast; and even in our backyards, city gardens, lawns, and parks, thrive innumerable little plants which contain food ingredients of no mean order. We are said to be a nation of bilious people because we ignore these "greens" and medicinal plants which nature has so lavishly spread about. Our stock animals show a better appreciation of their value by eating the leaves and roots of these vegetables, and thereby renewing their muscular vigor and vitality each spring.

Edible weeds is an appropriate term for these neglected greens, for nine out of every ten would call them weeds, and not think of classifying them as garden vegetables. Gradually people are beginning to adopt some of these edible weeds, and they now form a part of our dietary system. Thus the dandelion has gained considerable favor as a spring green, and tons of it are annually gathered and used. But we are still behind the Europeans in respect to the consumption of the dandelion. The market gardeners around Paris cultivate the dandelion on a large scale, and sell it for good prices in the market. The winter cress is another wild vegetable growth that has been accepted as a food product by the people of the Middle States. As a salad and pot herb it is quite highly valued in Washington and Baltimore.

But the list of popular green herbs of the field is quickly exhausted. Wild chicory, or succory, is considered a weed of disagreeable habits from the Atlantic to the Pacific, and it is only here and there that its leaves are utilized. In Europe it is raised in the gardens, and its leaves are even blanched the same as celery. It is a hardy, perennial plant that spreads rapidly, and if allowed to grow out of its proper place, it may prove troublesome in both pastures and lawns.

Charlock is another edible weed that grows in nearly every part of this country, and is looked upon as a nuisance by many farmers. In the wheat-districts of the Northwest it is particularly considered a pest. In the Eastern States charlock is often called the "wild mustard," and it is closely allied in appearance and botanically to the black mustard. In Northern Europe charlock is used extensively as a pot herb, and it yields medicinal properties that are of the utmost importance in the summer. Farmers should eat the leaves of charlock, and it would soon be kept down in its present untrammeled growth. Yellow rocket is a fine edible weed that only needs to be eaten to be appreciated. At present it is barely recognized by anybody except farmers, who kill it as a weed.

There are several varieties of the dock that are edible. The broad-leaf and the curl-leaf in particular should be eaten. Both of these are used as pot herbs in Europe. There is every reason to suppose that the American Indians used the dock as food, and also many other wild vegetables that we condemn to-day as useless weeds. Dock roots had a place in every kitchen herb garden of our early New England settlers, and every spring they were boiled up and taken as spring medicine as religiously as their prayers were said. There were no apothecarie's shops at every street corner then to run to for medicine, and each householder raised her own medicinal herbs. The result was that more edible weeds were then eaten as greens and as medicine than in these latter days. The leaves of the dock make good pot herbs, and should be eaten in regions where other greens fail to grow. Thus in the arid regions of Arizona, New Mexico, and Texas dock grows where all succulent green things fail.

A common edible weed in this country, which is cultivated in Europe, but entirely neglected here, is lambs-quarters, pigweed, or goose-foot, as it is variously called in different localities. When it once gets established on a place this green grows and spreads rapidly, and for that reason it has been counted a nuisance. Originally this weed was introduced in this country from Europe as a valuable food for pigs, but in late years it has been considered a pest, and its extermination is prayed for. Nevertheless, the pigweed is a fine summer green and pot herb. When properly boiled, it is tender and succulent. In California the Chinese have taken to cultivating the weed, and they thrive upon it and express great appreciation of its taste. The people of Mexico and the Indians of our Southwest also eat the pigweed in considerable quantities.

Our common pokeweed has been taken to France, and the gardeners have cultivated it as a pot herb, and it is looked upon favorably as an excellent green. But in this country it would be pretty hard work to induce any one to eat it. Yet it possesses all of the essential qualities necessary to make it a good green. Economic botanists claim that it should be more generally eaten for the sake of the medicinal qualities that reside in the leaves.

Even our common nettle, milk-weed, and round-leaf mallow are good food plants. They are edible weeds that thrive in abundance in all parts of the country, and often in places where few other plants will live. In Scotland, Poland, and Germany the tender leaves of the common nettle are gathered as a pot herb for soups or for dishes like spinach. The peculiar flavor of the weed is highly esteemed by the Germans, and it is mixed with cabbage, spinach, and similar greens to give piquant taste. The curled-leaved mallow is an annual plant originally brought to this country from Europe, where it is raised more for garnishing dishes than for eating.

Purslain is another edible weed that is abundant in nearly every old garden or neglected field. In Europe there are several cultivated kinds of purslain, but they all originally came from the common purslain of the fields. When mixed in salads, eaten boiled as spinach, or pickled, the plants make excellent summer diet. If the plants were regarded as edible weeds and not as useless, troublesome growths, the purslain would soon be kept from spreading. Rocket is a wild plant introduced from Europe, that one finds growing on the hill-side and even in the sandy spots in the upland woods. Its pale citron-yellow flower, marked with dark purplish veins, and with the fragrance of the orange blossom, is more commonly gathered than the plants. The flowers are considered very delicate and valuable prizes; but those accustomed to plucking the flowers should gather the young, tender leaves of the plant, and try them as a salad. A new appreciation of this plant will then be created.

Sweet cicely, or sweet-scented chervil, is sometimes cultivated for aromatic purposes, but as a seasoner for soups it answers a higher purpose. Formerly in England sweet cicely was put into salads, but its strong odor of aniseseed renders the salads disagreeable to many people. In soups, however, it is excellent, and the French invariably flavor most of their soup concoctions with it. Wood-sorrel is a common green that is being introduced gradually into our American cookery. Like dandelion it has become popular among some people. The pleasant acid taste of the leaves when mixed with salads imparts an agreeable, refreshing flavor that is greatly liked by epicures. In short, it is considered by culinary experts to be one of the best weeds that can be cultivated for their acid properties.

Shepherd's purse, found so abundantly in old gardens, and along the roadsides and waste places, is an edible weed that makes a fair substitute for spinach. It improves greatly upon cultivation, and in Europe some fine specimens are made to attain a diameter of nearly twenty inches. It has a mild and pleasant flavor. Besides being boiled as a pot herb it is delicious when blanched and served as a salad. Brook-lime, native to this country, is a salad plant equal to the water-cress. It is delightful in flavor, and healthful, being considered an excellent anti-scorbutic. Corn salad or fetticus is another wild salad plant that is found often in our wheat fields, but rarely cultivated in this country. The leaves of the plant when young are very tender, and they make excellent salads and pot herbs. Corn salad is a remarkably hardy plant, and it produces an abundant crop of good salad leaves. When full grown it is twelve to fifteen inches high.

The common cress, or peppergrass, is used by a few to flavor salads; but too many wait until the plant is too old to get the best results from it. The leaves should be cut long before the plant begins to flower, and then mixed with lettuce or other salad plants it adds a warm, pungent taste that is considered very tempting. It is also used for flavoring soups. The common sweet marjoram is a perennial edible weed that is highly esteemed in Europe for seasoning soups and meats. In this country where it grows wild it is almost entirely neglected. The whole plant is highly aromatic, and a little of it cooked in stews and meats imparts a delightful taste and odor. Moreover, it can be dried, and used in this way just as well as when green. Dried sweet marjoram in winter is excellent for flavoring meat stuffings, broths and soups.

The list of edible weeds might be extended further, but these include most of the common kinds, which nearly every one is familiar with. They are, with but few exceptions, looked upon as worthless weeds, but in reality they are edible plants of considerable value. In Europe nearly all of them are carefully harvested in the woods and fields or cultivated in gardens. In this country they are allowed to run wild, and few realize their value.

G. E. W.

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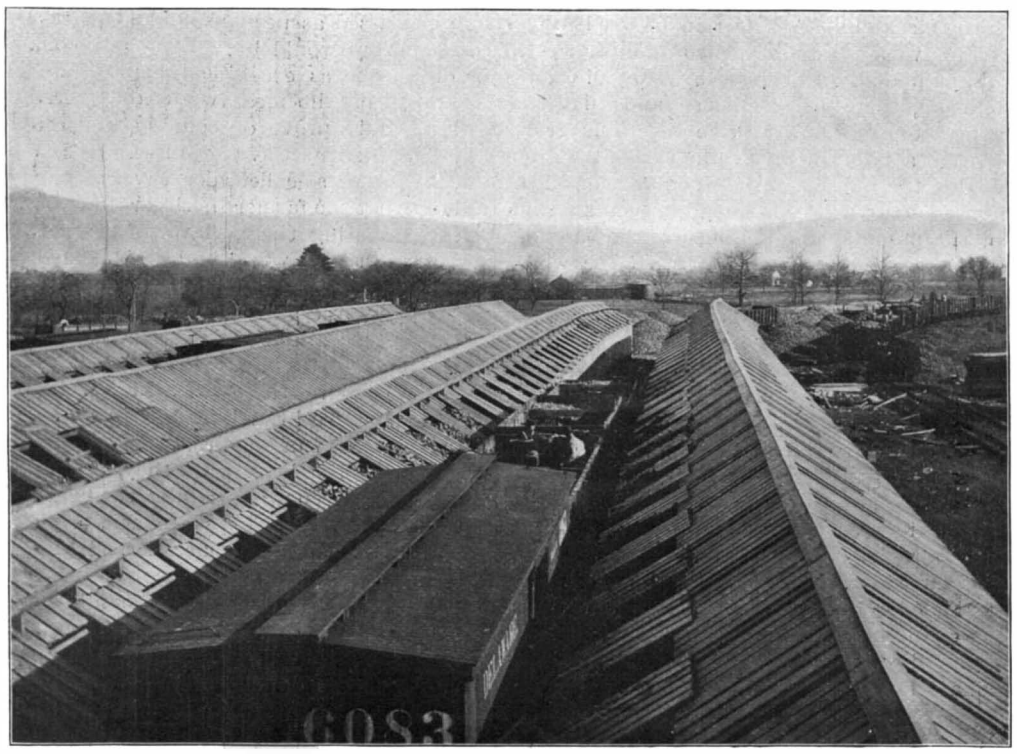
THE BEET SUGAR INDUSTRY IN NEW YORK STATE.

BY S. L. SHELDON.

At Binghamton, Broome County, N. Y., is located a factory which manufactures each day during the working season from twelve to sixteen tons of pure granulated sugar. The popular notion usually associates sugar with sugar cane and with tropical climates. But this popular notion must change, for the sugar supply of the world will soon be manufactured from the beet. Two factories are now in operation in New York State, one at Binghamton and one at Rome. A large sugar factory is also located at Bay City, Mich. Other factories are being planned in New York and Michigan, and it will be but a short time before this industry of the manufacture of sugar from beets will come into wide prominence. So important is the industry likely to become that a description of the Binghamton factory and the methods of extracting the sugar from the beets will prove of interest.



SHEDS FOR STORING BEETS, AND METHOD OF HANDLING.

The factory is located some three miles from the city of Binghamton on the Delaware, Lackawanna & Western Railroad. The main building is a substantial brick structure, and the storage room for the beets is partially provided for by four mammoth sheds, each 460 feet long, 16 feet wide, and 12 feet high. It was thought that these sheds would furnish sufficient storage room for the beets, but, from the photograph, it will be seen that many carloads have been dumped upon the ground; indeed, there are apparently more upon the ground than in the sheds, and they are being received from the farmers at the rate of 100 carloads each day. In the spring of 1898 some 2,000 acres of beets were contracted for; the farmers agreeing to raise the beets and the company agreeing to pay $5 per ton for the same.

Upon arrival at the factory the beets are unloaded from the cars into the sheds or upon the ground in the yard. Underneath each shed, and running its entire length, is a sluiceway through which runs water which has been heated to the boiling point in the factory. The beets are rolled into this sluiceway and the current is sufficient to carry them to the factory. The warm water so soaks and loosens the dirt that it is easily removed when the beets get to the washing machine. When the beets are unloaded into the sheds the hand work upon them is completed, and from that time they are carried forward by water or by machinery. As they near the end of the sluiceway they are seized by a screw elevator and raised to the factory, where the first operation is the washing. They are dumped into large tanks where revolving arms attached to a horizontal axis thoroughly churn them around and constantly work them forward toward the clean water. They pass from the first washing tank into a second one, and here the process is repeated and the beets are thoroughly cleaned. From the washing tanks they go to the bucket elevators and are carried to the top of the building. The next operation (pulping the beets) is done by a system of knives or scoops fastened to a horizontal wheel. The knives have scalloped edges and are situated at the bottom of a large hopper. As the beets come down upon these rapidly revolving knives they are literally cut into shreds or pulp. This pulp is put into what is called the "diffusion battery." This battery is really a system of great tanks so connected that the water can pass from one to the other. The water is put in upon the beet pulp and the sugar is soaked out, the water being passed from one tank to another until it has become saturated, when it is drawn off. The fresh water is always put in upon the pulp, which is most nearly exhausted of its sugar content. The waste pulp is carted out of the building and is almost entirely a waste product. It is relished by stock, and no doubt will soon be prized as stock food. The juice is drawn from the battery and a measured quantity is passed on to the lime tanks. Here it comes in contact with the milk of lime, which removes certain impurities. Carbon dioxide, which has been stored from the burning limestone, is forced into the mixture of milk of lime and the juices from the diffusion battery, and the lime is precipitated with the impurities which it has absorbed. After passing through various mixing tanks, the juice passes to the filter presses. Here the juice is forced through cloth and comes out almost as clear as water. After passing through two sets of these filter presses, the juice goes to the bleaching process. This is done by means of fumes of sulphur. The juice is made to drip slowly over a board filled with holes, and the sulphur dioxide is brought into intimate contact with every drop. All of these processes are preliminary to the "boiling down." After bleaching, the juice goes to what is called the "triple effect vacuum pans." These pans are simply large upright boilers which have had the air partially exhausted by means of pumps. The liquid boils violently in them at a temperature of 70° F., and the "boiling down" is greatly hastened. From the first boiling the juice goes to the sulphuration tanks, where it is again bleached. After passing again through the filter presses, all traces of sulphur and other impurities are removed. The "boiling down" is then completed in vacuum pans. The next operation is performed by the centrifugals. In these rapidly revolving cylinders the molasses is thrown off from the particles of sugar. The principle is the same as in the common milk separator, where the cream is thrown out from the milk. The sugar is very damp after being separated from the molasses, and is dried by being passed through a long, slowly revolving cylinder. This cylinder is raised at one end and the sugar is slowly moved along, passing over heated steam pipes until finally it comes out of the other end of the cylinder as crystallized sugar.

The most troublesome product to handle is the molasses, which is separated from the sugar by the centrifugals. It is stored in large tanks in a room heated to a temperature of about 115° F. After remaining there for three weeks, it becomes partially crystallized and is then taken out and run through the mill again, and a portion of the sugar is extracted. It is believed that American inventive genius will devise machinery by which this molasses can all be treated at once without the necessity of storing, and the sugar all removed. Indeed, it is said that the factory at Bay City, Mich., is so equipped that all the sugar is extracted within twenty-four hours.

Not all the sugar contained in the beets can be extracted. From a ton of beets analyzing 15 per cent sugar, about 250 pounds of sugar can be secured. The importance of high grade beets is very great, and the difference between beets containing 12 per cent sugar and beets containing 15 per cent sugar may mean the difference between profit and loss. To illustrate this point, the Binghamton factory has a capacity of 300 tons of beets per day, and the working season consists of about 100 days. If the 30,000 tons of beets used contain 15 per cent sugar, the output will be about 7,500,000 pounds of sugar. If the beets contain only 12 per cent sugar, the product will be only some 5,400,000 pounds. This difference of 2,100,000 pounds of sugar is an important consideration and accounts for the desire of factories to secure high grade beets.

The new industry promises much for those States which are favored with proper climatic conditions. It makes a new cash crop for the farmers, who are able to net from $25 to $50 per acre. It opens a new channel for capital and the investment under proper management is a safe one. The important problem now is to secure men trained in the business who are capable of managing American labor. It is found that foreigners, while they may have been successful in their home country, are not entirely adapted to the conditions which prevail here.

To American youths who will prepare themselves for the work of managers of factories there is promise of lucrative employment. Several of our large universities are considering the organization of "sugar" courses. Cornell University will, no doubt, have such a course in operation in the near future. The chemical work at a sugar factory also requires expert management, and the success of the factory depends to a large degree upon the fidelity of the chemist in charge of what is called the "control" work. The limestone is analyzed for impurities which would possibly be injurious to the crystallization of the sugar; the fuel is analyzed to determine the per cent of carbon; the juices are analyzed and tested at various stages to ascertain if the proper degree of acidity or alkalinity is present, for the slightest deviation means loss of sugar. The waste pulp is analyzed, and, indeed, the watchful eye of the chemist must be upon every operation.

CHEMICAL LABORATORY FOR TESTING THE BEETS, ETC.

There has been no industry introduced in recent years which has offered greater inducements for young men, or for the American farmer, or for the investment of capital, than the beet sugar industry.

THE expedition which was sent out by the Swedish government in search of Andree, the Arctic explorer who attempted to reach the North Pole in a balloon, has returned from Northern Siberia, where months were spent in fruitless efforts to learn the fate of Andrée and his two fellow voyagers.

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SIEGE GUNS AT THE WASHINGTON ARSENAL.

The accompanying illustration shows two types of siege guns, several of which were shipped for use in army operations at Santiago, but, like much other of the war material, failed to be brought into active service. The plan of operations contemplated bringing up these powerful guns to the heights surrounding Santiago and subjecting the city to bombardment before the final assault was made. The collapse of the transport arrangements, as the result of poor roads and not a little confusion in the various departments, deprived our army of the indispensable assistance of its artillery, not merely in the final operations against the city itself, but in the desperate fighting against its outer defenses at San Juan and El Caney. Had it not been for the opportune fact that Admiral Sampson, by careening his ships and giving his guns their maximum elevation, was able to throw shells over the hills into the city, Santiago would have had to be carried by assault, with a frightful loss upon both sides.

The two guns in the foreground of the picture are known as 7-inch siege-howitzers, the others are 5-inch siege guns. Both of these weapons, together with the 7-inch mortar, are designed for the attack and defense of inland fortifications and the inshore front of coast fortifications. It will be noticed that the 5-inch gun is a much longer weapon than the other. The greater length is used to give a higher velocity and flatter trajectory to the shell, as this gun is used for "direct" fire, as distinguished from the "high angle" fire for which the shorter 7-inch howitzer is designed. The 5-inch gun would be used when it was desired to breach the walls of buildings, destroy the fronts of earthworks, or burst shrapnel above and in front of bodies of troops. For the first kind of attack the 5-inch shells would be fitted with percussion fuses and the shrapnel would carry time fuses.

The particulars of these two weapons are as follows:

	Weight.	Length.	Weight of Charge.	Weight of Projectile.	Muzzle Velocity.	Muzzle Energy.	Penetration of Steel at Muzzle.
	lb.	ft.	lb.	lb.	f. s.	f. t.	in.
5-inch gun.....	3,660	12·2	12·5	45	1,890	1,045	6·2
7-inch howitzer...	3,710	8 5	10·0	105	1,085	857	3·8

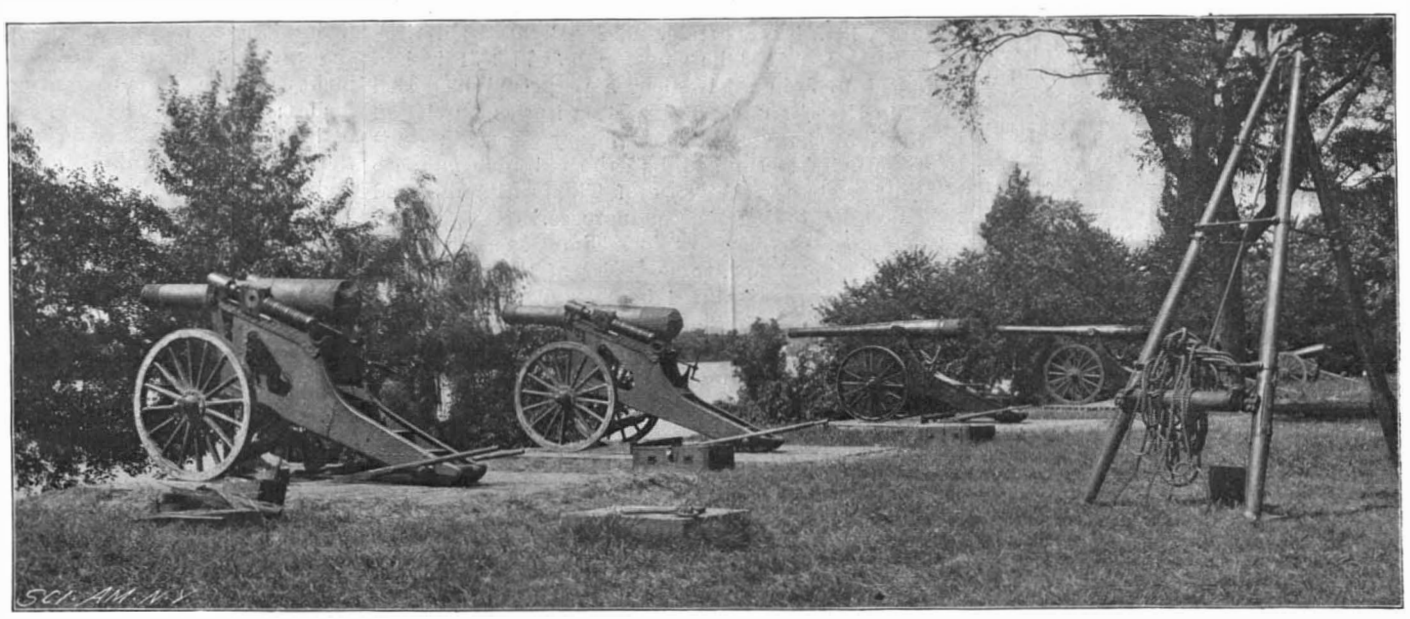
Although the penetration of the 5-inch gun at the muzzle is about double that of the 7-inch howitzer, the velocity of the lighter projectile falls off so rapidly that at 3,500 yards the penetration of the two projectiles is about the same, being 2·5 inches of steel for the 5-inch and 2·4 inches for the 7-inch weapon.

In the illustration the guns are shown in battery, or in the position they would assume when engaged in active firing. The carriage of the howitzer is made of two "cheeks" of ½-inch steel plate, which are tied together and stiffened by transverse plates, as shown in the engraving. The forward end of the carriage is securely fastened to a solid axle, and the cheeks are drawn together toward the rear to form the "tail," which rests upon the ground and forms with the wheels one of the three points of support. The gun rests by its trunnions in sliding trunnion-pieces, which during recoil travel upon planed surfaces upon the top edges of the cheeks. The recoil is governed by two hydraulic cylinders in front of the sliding trunnion-pieces and the gun is returned to the firing position by strong coiled springs behind the trunnion-pieces. Below the carriage is a hydraulic buffer, one end of which is fastened to the timber gun platform and the other to the gun carriage. When the piece is fired, the first shock of recoil is taken up by the upper buffers and through them is transmitted to the buffers below the carriage. The latter can be plainly seen in the second of the 7-inch guns in our illustration.

To the rear of the recoil springs will be noticed a second pair of trunnion beds. These are used when the gun is "limbered up" for transport, the gun being placed in them for that purpose. The object of thus shifting the gun is to divide its weight more evenly between the gun carriage wheels and the wheels of the limber. The gun is elevated by means of the hand-crank, seen at the rear of the carriage, which acts through a shaft and worm on an elevating arc attached to the howitzer at the trunnions. To allow for recoil, the worm is left free to travel along the shaft.

The 5-inch gun-carriage is similar to that of the howitzer, except that there is no sliding trunnion-piece, the gun resting directly on the cheeks of the carriage. The recoil is checked by a hydraulic buffer below the carriage, the cylinder of which is fixed to the platform and the piston-rod to the carriage.

The gun is elevated by means of the double screw which can be seen in the illustration, reaching from the carriage to the breech of the gun. Like that of the howitzer, the carriage is provided with traveling trunnions into which the gun is shifted when limbering up.



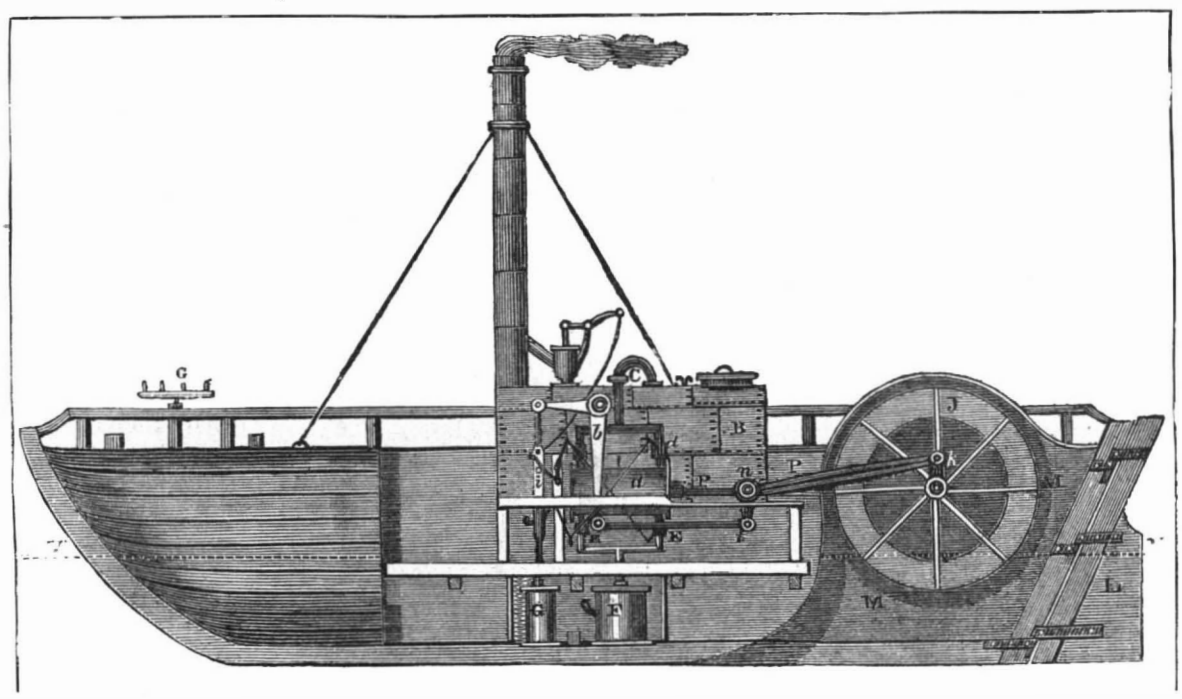
7-INCH SIEGE HOWITZERS AND 5-INCH SIEGE GUNS AT THE WASHINGTON ARSENAL.

A CURIOUS land subsidence took place at Northwich, England, November 15, 1898. The inhabitants were alarmed by the sudden subsidence of a portion of the London main road. The road was built on timber, and when the subsidence began it shortly—within an hour, in fact—became impassable. Buildings were thrown nearly four feet off the perpendicular, and the supply of water, gas, and electricity was interrupted. The area of the depression extended to about 440 yards and was 9 feet deep in the center. The cavity thus formed was filled with water. Great fissures appeared in two buildings, which had to be steadied with bolts and timber.

ROBERT FULTON AND THE STEAMBOAT.

BY PROF. ROBERT H. THURSTON, OF CORNELL UNIVERSITY.

In an early volume (1833) of The Journal of the Franklin Institute, our oldest technical periodical, is published a letter from Mr. W. Symmington, referring to a steamboat built by his father in 1803, and asserting that Robert Fulton, "the American engineer, was on board the 'Charlotte Dundas,' took sketches of her machinery, and received ready answers to the questions he thought proper to put. Several years after his first vessel appeared in America." It is stated that the boat, of which a picture is given, was successfully used in towing, and took two ships at one time against a strong head wind. In view of these claims for the foreign inventor, I have been often asked where lie Fulton's claims, and to what degree is he to be credited with the origination of this modern system of transportation.



SYMMINGTON'S STEAMBOAT, 1803.

In a word, it may be said that Fulton is entitled to quite as much honor for originality in the invention of this system as any one of the many men working at the problem in his time—a problem as old as the steam engine, or older—and attempted by many men before either Fulton, Symmington, or Bell, the Scotch engineer, who is also often upheld as "the" inventor of the steamboat. As regards Fulton, and probably, in their various ways, many other men as well, as the writer has elsewhere remarked, "He was an inventor, and a great one; but he did not invent the steamboat, or, so far as is known, any part of it. H was a talented artist, but his renown does not in the least rest upon his fame on that score. He was a civil engineer and accomplished in that branch of the constructive professions; but the fact is, to-day, almost unknown, even to members of his craft. He was an eminent mechanic; but the 'Clermont,' his first steamboat in America, did not illustrate his genius in that direction."*

The statement of Symmington may be, very probably, found positively and precisely correct; but it detracts not an iota from the merit or fame of Fulton. He had then long been engaged in the prosecution of the task which, ultimately, made him famous by its successful completion. Steamboats had been experimentally built, in 1707, by Papin on the Fulda, in 1736 or earlier by Jonathan Hulls in England, in 1763 by William Henry in the United States, in 1774 by James Rumsey on the Potomac, and later tried in the presence of Washington and other notables. In 1786 John Fitch built his first steamboat, and, for several years, he was experimenting, often with considerable success, on the Delaware. His boats ran thousands of miles, and carried many passengers and much freight between Philadelphia and the towns along the Delaware. He built a screw propeller in 1796; but the idea of a screw was older than James Watt, and, certainly, as old as Bernouilli. Patrick Miller, in Great Britain, built a steamboat in 1786 or 1787, and Symmington was one of his partners in 1788. In France, the Count d'Auxiron, as early as 1770, proposed to build a steamboat planned by the Marquis de Jouffroy, and one was constructed on the Seine in 1772; but it was unsuccessful, and renewed attempts were made, some with fair success, for several years.

In 1776 the same plan was constructed by the inventor, Jouffroy, as was later adopted by Fitch, a boat pro-

*Life of Robert Fulton; "Makers of America Series," 1891.

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pelled by duckfeet paddles. In 1783 the public trial of one of his boats attracted much attention.

John Stevens built his first screw boat in 1804, his twin screws in 1805, and his first paddle steamer in 1807, almost simultaneously with Fulton's construction of the "Clermont." But Fulton had been at work a long time then.

Fulton was born in Little Britain, Pa., in 1765. He was an inventor and mechanic by nature, and as a boy did many remarkable things; inventing the lead pencil, a rocket, and an air gun and designing guns and gun stocks for the gun makers of his town. He invented a paddle boat in 1779, and finally went to England and to France to introduce his inventions in the improvement of canals, and for other purposes, and to seek fame as a portrait painter, in which art he was extraordinarily proficient. William Henry, Benjamin West, the American minister to France, Mr. Barlow, and other distinguished people were already on the list of his friends. While in France, in 1797, he proposed the construction of a steamboat; but it was not until 1802 that he was ready with his plans. In 1803 his boat was completed and a trial trip was made on the Seine. It made about 4½ miles an hour. One of its special features was a water tube "safety" boiler, invented by Barlow, and patented by him in France as early as 1793. This boiler may still be seen in the Conservatoire des Arts et Sciences in Paris.*

Meantime, Fulton was inventing forms of submarine boats and of torpedoes, and endeavoring to secure their adoption by all nations, with the hope, as he declar s, that their use would ultimately compel all countries to forego naval wars, and even, probably, to guarantee "the freedom of the seas"—an outcome for which he devoutly prayed and industriously worked. Fulton, failing to secure the recognition which he thus sought, finally returned to the United States in 1807.

While preparing for his return, he had ordered of Messrs. Boulton and Watt a steam engine of a special design, thought by him to be best suited to his purposes, and had contracted with a New York shipbuilder, Charles Brown, for a hull in which to establish his engine and boiler. On his arrival, he forwarded the work as rapidly as possible, the machinery having arrived and the boat being well in hand. The work was begun in the winter of 1806-7, and the boat started on her trial trip to Albany in August, 1807. The success of that experiment proved the foundation of our present system of steamboat transportation.

While Fulton was thus supplementing, with success, the work of earlier engineers and mechanics in the United States, and was inaugurating successfully the era of steam navigation, work was progressing in Great Britain. Miller, Taylor, and Symmington, building the "Charlotte Dundas" and other successful boats, led the way, and Henry Bell, building the "Comet" in 1812, finally took the place, in that country, that Fulton had conquered on this side the Atlantic.

It would be folly to attempt to discriminate accurately among the many zealous, ingenious, and persevering workers at this then familiar problem with a view to assigning to each his exact proportion of merit and of the awards of fame. Like the problem, to-day familiar to every engineer and mechanic, of perfecting the gas engine, or like the hardly less familiar problem, with men of science, of obtaining light or heat or electric energy, each distinct and unmixed, from fuel oxidation, the problem of steam navigation was in the minds of many men. As the famous civil engineer, Mr. Benjamin H. Latrobe, of Philadelphia, wrote at the time, "a sort of mania" prevailed for discovering a way to propel boats by means of steam engines. Fulton was one of these thus afflicted, and he proved successful commercially. Other quite as talented inventors, and quite as successful, so far as construction and invention went, were not able to attain a commercial success, and Fulton, as the fittest to survive, in a business sense, became immortal; though not an inventor like Watt, or like Fitch or Stevens.

John Stevens, and his talented nephew, Robert L. Stevens, were better designers and greater inventors than Fulton; but they were distanced in the race for fame and fortune, at the time, by Fulton. His mantle fell upon them after his death, and when the monopoly, illegally conferred upon Fulton and his backers, of the navigation of the Hudson River by steam, was destroyed by the courts, it was then to the Messrs. Stevens, not to Fulton, that the nation became indebted for the organization of steam navigation on the waters of our Atlantic coast, on an extensive scale and permanently.

As the writer has written in concluding the biography of this great mechanic, engineer, statesman, and prophet, for he was all these: "Steam navigation without Fulton would undoubtedly have become an established fact; but no one can say how long the world, without that great engineer and statesman, would have been compelled to wait, or how much the progress of the world might have been retarded by his failure, had it occurred. The name of Fulton well deserves to be coupled with those of Newcomen and Watt, the inventors of the steam engine, with those of George and Robert Stephenson, the builders of the locomotive, and with those of Morse and of Bell, who have given us the telegraph and the telephone."

"We use nor Helm nor Helms-man. Our tall ships
Have Souls, and plow with Reason up the deeps;
All cities, Countries know, and where they list,
Through billows glide, veiled in obscuring Mist;
Nor fear they Rocks, nor Dangers on the way."
—"Odyssey," Book VIII.

*Ibidem, p. 113. Vide Thurston's History of the Steam Engine; p. 255.

An Indian Hospital for Animals.

Orientals are proverbially obstinate, and it takes a long time and much patience to make them believe in ideas which emanate from the West. For example, horses are rarely seen running loose in a field in India, "because horses" says a native, "always have been tied up and they must always be tied up." This obstinate clinging to tradition is the cause of much of the Oriental indifference to suffering. The Bai Sakarbai Dinshaw Petit Hospital for Animals seems one of the most remarkable examples of the manner in which, by slow degrees, western civilization has influenced the Orient. The hospital is situated near the government house at Parel, Bombay. It was founded in 1883 by Sir Dinshaw M. Petit, Bart., a Parsee mill owner, and was formally opened in 1884 by Lord Dufferin. The hospital occupies an area of 40,000 square yards of ground, and there are about forty buildings, large and small, on the premises. The entrance gateway and the large fountain in the center are excellent examples of Indian architecture. The native cotton and grain merchants and mill owners of Bombay have organized a system of voluntary taxation upon the import and export of grain and seeds, and on the sale of cotton to the local spinning and weaving mills, by which the sum of 40,000 rupees a year is collected for the maintenance of the institution. There is also a large endowment, the interest of which is devoted to the current expenses of the hospital.

There are five cattle wards, two horse wards, one dog ward, a consultation ward, a forge shop, a dispensary, post-mortem and dissecting room, a chemical laboratory, a pathobacteriological laboratory, and a veterinary college is connected with the hospital. The college is maintained at the expense of the government. At the hospital there is accommodation for 200 head of cattle, 60 horses and 20 dogs.

The hospital is unique of its kind in the world, and animals belonging to poor owners of the public carts and conveyances plying for hire are treated free of charge. A nominal fee is levied for feeding the inpatients. The splendid manner in which the whole hospital is arranged and run is an object lesson to the countries of the West. The Graphic recently had interesting pictures of this hospital.

Another Gutenberg Bible Sold.

Recently at the Rev. William Makellar book sale in London a copy of the Gutenberg Bible on paper, with a number of margins mended and several slight defects remedied, was sold for £2,590. It is the same copy that in 1822 fetched £168 at the Perry sale, £190 in 1841 at the Duke of Sussex sale, and £3,900 in 1884 at the Sir John Hayford Thorold sale. At the Thorold sale, when it was described as a magnificent copy, it was purchased by Jackson, the book dealer. In January, 1897, it was catalogued by Bernard Quaritch and priced at £4,000, he showing how in 1471 it had belonged to Johan Vlyegher, a perpetual beneficed priest in Utrecht Cathedral. Later it was purchased by the late clergyman, whose library was sold recently at Sotheby's. He had had the old blue morocco binding (probably the work of Thouvenin) replaced by a modern binding of green morocco.

There are, says The New York Times, as most people perhaps do not know, three copies of the Gutenberg Bible, the first of printed books and incomparably the most precious of all books, in New York libraries—the Lenox copy on paper, for which James Lenox paid £500 in 1847, at the Wilks sale; the Brinley-Cole-Ives copy on paper, now in the library of J. W. Ellsworth, which brought $8,000 in 1881 at the third Brinley sale and $14,800 in 1891 at the Ives sale; and the vellum copy in the collection of J. Pierpont Morgan. The following are the highest prices given at auction for copies of the Gutenberg Bible:

Ashburnham sale, 1897, vellum copy	£4,000
Thorold sale, 1884, paper (present copy)	3,900
Perkins sale, 1873, vellum copy (resold at Ashburnham sale for £4,000)	3 400
Ives sale, 1891, paper copy	2,960
Perkins sale, 1873, paper copy (now in Alfred H. Huth's library)	2,690
Sotheby sale, 1898, paper copy (present copy)	2,590
Earl of Crawford sale, 1887, paper copy	2,460
Lord Hopetoun sale, 1889, paper copy	2,000

OUR French contemporary Cosmos recently published an interesting photograph taken with the telephotographic lens. Lenses of this kind have proved very useful in Europe; for example, officers of the Italian engineers have recently been able to discover in the Alps French batteries which had entirely escaped notice, and they were able to observe the details of their construction.

Science Notes.

Prof. Roentgen, discoverer of the X-rays, has been called to the Chair of Physics at the University of Leipsic from the University of Wurzburg.

A new dormitory has just been begun at Princeton University. It is the gift of Mr. H. S. Little of the class of '44, and is to be known as "Stafford Little Hall." It is near Blair Hall and follows out the same general design. Princeton is fast becoming a veritable Oxford in appearance. The new building will cost $100,000, and Messrs. Cope & Stewardson, who designed Blair Hall, are to be the architects.

A curious instance of dwarfism in pines is recorded by Mr. C. E. Bessey, of the University of Nebraska. On Green Mountain, near Boulder, Colorado, he found in a crevice of the rock at the summit a pine tree (Pinus albicaulis, Engelm.) only 13 centimeters (under 3 inches) high and 5 millimeters (⅕ inch) in diameter. It had no branches and bore a single tuft of needles at the top. Nevertheless, it showed 25 distinct annual rings, and was, therefore, 25 years of age.

It is not generally known that peat may be used for textile purposes, and also for paper making. The exhibits at the Vienna Exhibition last year demonstrated this fact conclusively. Peat straw may also be used for many purposes, such as fertilizing, packing, etc. When used for textile purposes it must be woven without the use of oils or water. Coats, hats, carpets, rugs, ropes, matting, and pillows are some of the articles which have been made and which have been found useful. It is also a valuable substitute for absorbent cotton, possessing antiseptic properties as well.

Ch. Michel publishes the results of recent analyses of woman's milk. Samples were taken morning, noon, and night, mixed and then examined. From the study of the data derived from seventy-two analyses, he found that it was possible to draw a wide distinction between the milk of women recently accouchees and those who had passed that stage, a period varying between two and twelve months. Thus the milk of the former was notably richer in nitrogen compounds, extractive matter, and mineral salts, while it was poorer in fat (beurre) and in lactose.—Répertoire, x., 452.

As is well known, Napoleon Bonaparte died of carcinoma of the stomach, at the age of fifty-two, his father having previously died, æt. thirty-eight, of the same disease. When Napoleon was born his mother was very young, between sixteen and twenty. In commenting upon these facts, Mr. Hutchinson, in the new number of his Archives, states that cancer is more common in the children of aged parents than of young ones, and suggests that the outbreak of cancer in Napoleon was probably due to inheritance, coupled with the depressing and annoying conditions under which his last years were passed.

We have recently published two illustrations of pygmy locomotives. We have been favored by Rev. J. J. Gilchrist of East Las Vegas, New Mexico, with the description of an engine built at a factory in that place by W. L. Adion. It is a passenger locomotive built to a scale of $\frac{1}{12}$ of the standard, and is propelled by gasoline. It measures 4 feet 7 inches from the top of the cowcatcher to the back drawbar. The boiler is 20 inches long and the height from the rail to the top of the stack is 17 inches. The width of the track is 7½ inches and the diameter of the driving wheels is 5½ inches; the cylinders are 1½ × 2½ inches. The little locomotive has been used to run up and down the center of a dining table with small cars attached to facilitate waiter service. We have heard of miniature electric railways being used for the transportation of viands, but we have never before heard of a locomotive engine being used for this purpose. It might be a novelty, but, on the whole, we do not believe it would be agreeable or acceptable in the East.

Austrians are very methodical in many things, and they take no chances with their barbers. The barbers and wig makers' union of Vienna sees to it that only competent persons are admitted to practice. The barbers must of course have a thorough knowledge of the practical side of the subject, and they are questioned as to keeping razors, brushes, etc., clean, and the general idea of antiseptics must be well understood by them. When the barbers appear before the committee they have their razors dulled on a pine plank, and they must then sharpen them and proceed to shave a subject. These subjects are recruited from the poor and from among those who are fond of getting something for nothing. If the apprentice performs his work to the satisfaction of the judges, a certificate is issued to him and he must serve as an apprentice for two years before he can open a shop of his own. Provision is also made for women barbers who desire to carry on the business of their husbands. To do this the women have to be enrolled as apprentices for three years, and they must exhibit a great proficiency before they are allowed to open an establishment of their own. The barber business in Austria is not particularly lucrative, as one can be shaved for 5 cents and have one's hair cut for about 3 cents.

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Correspondence.

Curious Freaks of Lightning.

To the Editor of the SCIENTIFIC AMERICAN:

Near this place, last summer, a negro who was plowing with a double team, perceiving that a storm was rapidly approaching, unhitched his horses from the plow and, mounting one and leading the other, started for his home, near by. He had gone only a short distance when both horses were instantly killed by a bolt of lightning while the negro escaped without injury. He was slightly shocked and complained for a time of pain in his limbs, but was soon entirely restored. The horse the negro rode was slightly in advance of the other, by the length of the bridle rein and the extended arm of the negro, the led horse not keeping abreast of the other, but lagging a little in the rear. The escape of the negro, under the circumstances, seems almost marvelous, and to the unscientific mind is wholly inexplicable. Will you kindly explain upon what theory the negro's escape can be accounted for?

F. E. BUFORD.

Lawrenceville, Va., December 1, 1898.

[There is no theory for such occurrences. They are facts which are met with every summer, during the season of thunder storms. It does not explain the matter to say that the discharge passed around the rider but passed through the horses.—ED.]

Fire and the Modern Skyscraper.

To the Editor of the SCIENTIFIC AMERICAN:

Any communication appearing in such a high class periodical as this carries with it much weight from its publication alone, and is certain to be very widely read. In your number for December 24 is a letter filled with the most sarcastic criticisms of the operations of the New York Fire Department at the fire which damaged the "skyscraper" block on Broadway early in the same month. The powerful engines in use that night are derided as "little squirt guns on wheels," and the apparatus in general is ridiculed most extravagantly. The opinions of the famous chief of that most efficient organization are scornfully condemned, with a side fling at the fire authorities of Philadelphia. In brief, our present system of city fire protection is bitterly denounced as unable to cope with what we are to understand are modern conditions, and our experienced chiefs are assailed because they unite in urging a safe limit to the height of buildings.

Now, while neither chief nor firemen are likely to be distressed by this, and know better than to expect everybody to appreciate their heroic work on that stormy night, there may be some of your readers who would like to know whether to pin their faith in the advocates of these monstrous buildings or in the fire chiefs with their many years of service. They may ask whether the opinions and advice in this letter of December 24 are really valuable, or whether they are to be classed with the excited comments that may be heard from the "curbstone critics" among the spectators at every large fire!

To begin with, it would seem that one reason for such a caustic letter lies in the fact that, so far, the chiefs are having much the best of the discussion, and that thinking people are listening to them more than ever. This particular fire resulted exactly as predicted by such authorities as Chiefs Bonner, Swenie, and Baxter, who have from the first contended that, while fires in these towering structures might be fairly well handled as long as the heat is not too great to allow the firemen to work inside, the tremendous amount of heat thrown against a "skyscraper" by a hot fire alongside would cause immense damage, to say the least. This is precisely what happened. A five-story building burned in a high wind, and from it such a mass of flames arose that the adjoining twenty-story structure became ignited through the windows, and a heavy loss followed. Yet we are told by this writer that "skyscrapers" are preventers of conflagrations, and that a law should be passed requiring the erection of a double row of them, the length of Broadway. "Who ever heard of a serious fire originating in a 'skyscraper'?" asks he

It must be admitted that last month these pretended bulwarks were pretty thoroughly riddled aloft by the heat from their insignificant neighbor. What if this latter had been twice as large and had kept up its heat longer and in greater volume? What if the fire had come rolling up to the twenty-story structures with the blast and heat of two or three squares of real conflagration behind it? If we may judge from the actual work of the flames on December 4, the "skyscrapers" would have been reduced to skeletons, even if they did not buckle and fall in a tangled mass! Yet, if the Rogers & Peet concern, where the fire started on that unlucky occasion, had been surrounded by buildings of somewhere near its own size, the whole loss would have been confined within its walls, for the fire department controls many such fires every year with little or no damage to adjoining property.

There are happily not many of these "modern" structures in any city, and this is one reason why we have not yet heard of a serious fire originating in one of them. Another is, that being few in number, they are as yet used exclusively for office purposes and the contents are not especially combustible. Let them be erected in such numbers as to compel their use for mercantile business, storage, or light manufacturing, and we shall see them cause fires of appalling magnitude, and this in spite of as good "fireproof" construction (so called) as has yet been devised. What would it avail to build a twenty-story building of such material, if every floor were unbroken in area and piled full of the miscellaneous stock of a modern department store?

But your correspondent writes that each "skyscraper" must have a water system of its own for interior and exterior protection, and the supply for these systems must come at a high pressure through pipe lines from fireboats at the rivers. Let us see how this would work, for we are assured the plan would be such a brilliant success that steamers, towers, and other heavy apparatus might be done away with altogether!

In attacking a fire inside any one of these tall buildings, the great problem is to speedily place firemen on the endangered floor. To get the water there is easy, for any one of the despised "squirt guns on wheels" can, by means of a standpipe, operate a heavy fire stream even on the very roof of a structure like the Park Row building, 390 feet from the sidewalk! A fireboat is not to be considered at all for such work when each minute may be worth an hour, as she must pick her way among crowded shipping to the proper landing, and make various attachments to dock and pipe inlets before the pumps can even begin forcing water toward the fire many blocks away. Hence while these boats and their pipe lines are most powerful and valuable auxiliaries to the street forces, they can no more be depended upon for quick work at a remote point inland than can a steam fire engine be expected to get "first water" on a vessel anchored in midstream. Our amateur critic might have been suspected of some knowledge of his subject had he suggested district pumping plants at the rivers, connected with systems of mains kept always filled and under pressure for service at a moment's notice. Surely nothing less would serve the purpose if our "tiny steam fire engines" are to be "washed into the bay," and the interior pipe systems are to extinguish the incipient fires. Still there is nothing in any of these suggestions to provide for getting men to work the streams into the aerial regions where the fire may be playing havoc. It frequently happens that the elevators are not running, and then the delay involved in climbing the stairs is likely to be very disastrous. And if there are either large areas or combustible materials to be encountered when they do get there, the bravest fire fighters may be compelled to retreat, and then what hope is there for the building? We are informed that streams may be thrown in from other "skyscrapers," but there may be none near enough, and outside streams are only partially effective at the best, especially in a high wind. There are automatic appliances that would be of great assistance if the owners of the buildings could be made to see the necessity for installing them, but they could not be depended upon altogether.

We are further informed that adjoining buildings might be thoroughly drenched with water from our "skyscraper" water systems, and it is not to be denied that such a mode of attack would often be useful. A practical fireman would be apt to suggest, however, that water cannot be thrown in that manner into a low building from above until the roof burns off, for the whole affair is designed to shed water; and after the fire gains that much headway, the chances are likely to be at least even between the furiously ascending flames and the largest streams of water that can be controlled from above. After all points are considered, it is likely to be decided that the "skyscraper" people had best devote their entire attention to protecting their own windows, in time of fire, for there is no certainty that they may succeed in doing that!

In at least one other city a hot fire entirely opened a large section of an adjoining steel frame monster, but was fortunately checked when the heart of the structure was exposed. This gives a fair idea of what a conflagration would do, and yet our fire chiefs are called "old fogies" because they will not shut their eyes to the possibilities involved in the general building of "skyscrapers"!

Being something more than mere theorists, it is certain that our chiefs will continue to stand together in demanding a limit to the height of buildings. They are heartily in favor of fireboat pipe lines, auxiliary steam or electric pumping systems or any other aids that may be summoned as reserve forces in case of large fires. but there is nothing in their experience to indicate that the general installation of all these helps would justify the building of more "skyscrapers,"

HARRY W. BRINGHURST,
Secretary Pacific Coast Chiefs.

Seattle, Wash., January 5, 1899.

Sights and Range Finders for Our Coast Defense Guns.

The War Department has placed an order with Warner & Swazey, of Cleveland, for three hundred telescopic sights to be fitted to the coast defense guns of the United States. The addition of these sights will, it is thought, increase the accuracy of the fire of these weapons, and they would be of great value in case of emergency caused by the destruction of a range finder. In appearance they somewhat resemble the Scott sight used in the English coast service. They differ from the English sight in producing an irregular image by means of Brashear prisms. This is accomplished without increasing either the diameter or length of the telescopic tube. The subject of a telescopic sight for great guns has given the ordnance officials no little concern for some time, says the special correspondent of The Evening Post. Owing to the limited demand for the instruments, there were not sufficient inducements for American opticians to work out the problem, but the Spanish war awakened American makers to the fact that there was a real demand for first-class sights, and the present instrument is the result.

The new sight has a field of view of six degrees. The deflection scale is graduated to three minutes of the arc, and the greatest reading is two degrees thirty minutes each side of the zero mark. The deflection can be adjusted by means of an outside scale at any time by the gunner without removing his eye from the eye-piece. The new sight is adapted for either field, siege, or coast defense service. With the present order the War Department will possess nearly four hundred and fifty telescopic sights for great guns. The same correspondent says that the War Department has settled upon the Lewis range finder. A number of ordnance officers has reported that for secondary stations either the Lewis or Rafferty range finder might be used. For primary stations the Lewis range finder was alone recommended. Besides range finders, orders have also been placed for azimuth instruments for use in obtaining ranges in siege batteries. It is proposed to have on hand at all times a sufficient number of these instruments to equip any number of siege batteries that are likely to be assembled.

Horseless Vehicles.

As The New York Herald says, the automobile has captured the fort and is here to stay until superseded by something better. In all its picturesque ugliness, it is a boon and a blessing. It looks like a hackney-coach with the delirium tremens, but it is a sober-minded, straightforward vehicle. We not only give it our respect but our admiration, for, with its big rubber wheels, it gets over the ground in a velvety sort of way and reaches its destination without becoming tired.

It does not take long for a new invention to vindicate its right to exist if only it proves useful. When this queer-looking thing, a kind of caricature, first made its appearance, nobody knew whether to laugh at it as a good joke or to become indignant at the intrusion. By slow degrees it worked its way into our affections, and now we love what we aforetime abhorred.

The principle on which it is built is being so expanded as to include the heaviest sort of drays, and the hour is not so far distant when no horses will be in sight below Central Park. The gentle brute has had his day, but he will soon be a relic of the past except for purposes of pleasure. He has done his duty well, but he roused our sympathies in slippery weather and proved that four feet are not enough to stand on when the streets are icy.

All hail to the automobile, and may some gifted genius soon arrive who will whip it into shape and make it presentable! All things are possible, even a good-looking horseless carriage.

Work on the Botanical Garden.

The work on Horticultural Hall in the new Botanical Garden in Bronx Park, New York, has begun, and the building, which is to be of iron and glass, will be finished and ready for occupancy by October 1 of this year. The hall will be 512 feet long and 60 feet wide, and the central dome is to be 90 feet high and will allow palms 75 feet high to be kept in it. The new building is about 1,200 feet south of the museum building of the Botanical Society. New collections of the flora of Porto Rico, which have been made by funds donated by Mr. Cornelius Vanderbilt, will have a place in the hall.

ONE of the most serious objections to celluloid articles has always been their liability to easy ignition; but we are now informed by a contemporary that celluloid may be made uninflammable by dissolving 25 parts of ordinary celluloidine in 250 parts of acetone, and then adding sufficient of a solution of 5 grammes of magnesium chloride in 15 grammes of alcohol to make a paste: this forms when the proportions of the first named and the latter solution are about as five to one. After careful kneading and drying the resultant material is said to be quite incombustible.

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THE ROYAL PALMS OF CUBA.

Not only is the climate of Cuba favorable to the planting of crops whenever the farmer chooses to plant them, and the lands so rich that no fertilization is ever required, but Nature seems to have, with a beneficent hand, reared many strange trees and plants to supply the wants of man without the necessity of his planting them himself. First among these are the palms, some twenty-six varieties of which adorn the fields of Cuba, giving shade, food, and life. At the head of these stands the royal palm.

Since the time when Columbus discovered America the regal or "royal" palms have been admired by all that have chanced to view them. Their designation of "regal," however, obtains to two different species, viz., the Oreodoxa regia and O. oleracea, the first being rather more sparingly distributed than the second, though both range within limits from 40° north to 35° south latitude.

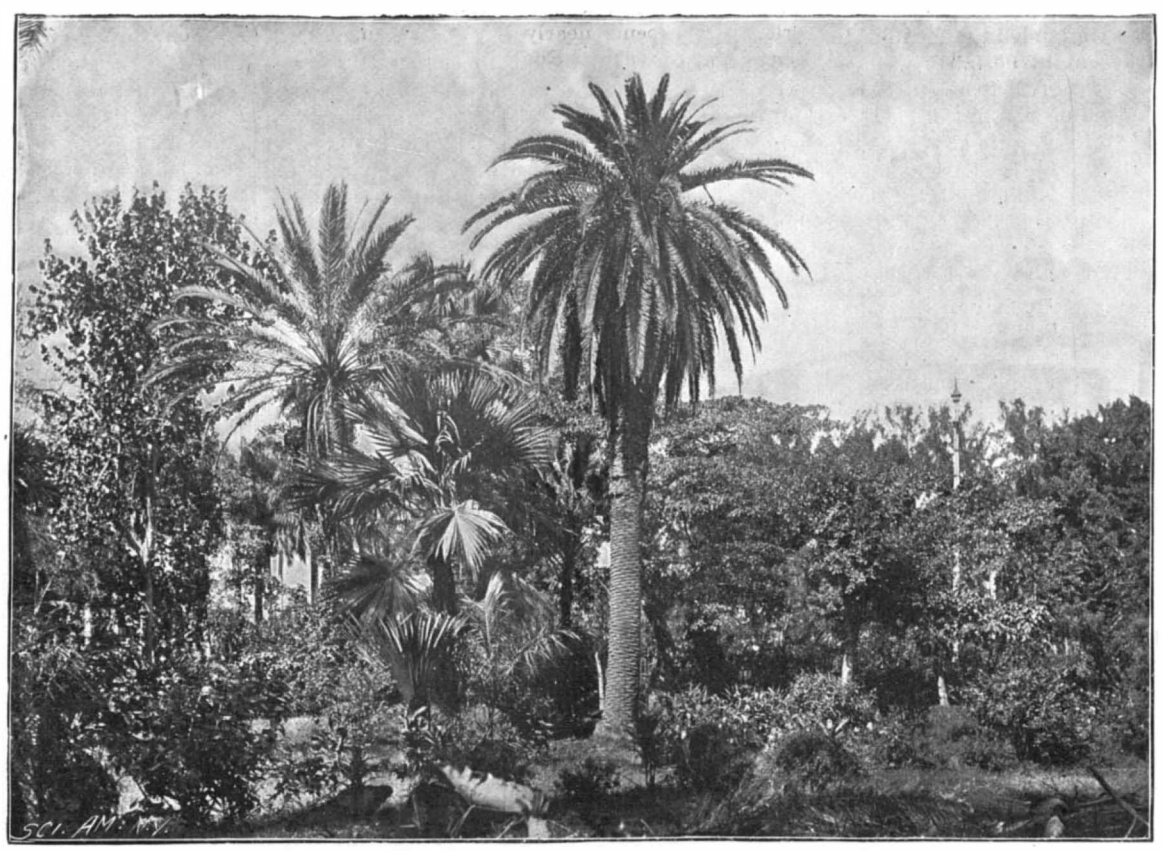
O. regia as named by Humboldt and Kunth, the Oenocarpus regia of Sprengel, and the "palma real de la Havana," is one of the most common palms in Cuba, where it is frequently employed for the making of avenues, a purpose to which it is admirably adapted; it has also been introduced into Teneriffe. It is the extent, regularity, and unrivaled beauty of this species that have rendered famous the long avenue in the Botanical Gardens of Rio de Janeiro. Here they form a colonnade of natural Corinthian columns whose graceful, bright green capitals reach forty yards above the ground.

The royal palm consists of a tall, straight trunk of a very fibrous nature and supports a cluster of tennated leaves like a bunch of plumes on a long stick. The leaves are large and leathery. These leaves continue to grow from the center to a great length. When the leaves cannot grow any more, they drop to the ground from the bottom of the cluster, thus making room for the new ones which are always coming out of the center. It also yields in the proper season yellow flowers which are somewhat singular in that they possess both stamens and pistils, the majority of the palms being unisexual. The fruit cannot be eaten. The stem of the long leaves is peculiar. It is semicircular, and embraces the trunk of the tree and holds the leaf in place until it withers and drops to the ground. It resembles a thin board and is often of great size, and it has a number of uses. The trunk of the tree is without any bark and its center is very porous, increasing in density toward the outer surface. From the hard outer shell of the trunk canes are made. The bud or root of the center spire from which the leaves grow consists of a tender substance buried deep down within the cluster of the green leaves, and forms a very palatable food either in the raw state or cooked as a vegetable. It is also made into a preserve with sugar. The royal palm is one of the most common of all the trees in Cuba. It is met with everywhere, and in the center of the broad pasture lands it often stands alone. Bordering the cultivated fields of rich planters, it forms shade avenues which lead to the dwellings.

The "cabbage" palm (O. oleracea), equally straight-stemmed, rises to even greater heights; some seen by Seeman measured 170 feet, and but little less are the giants that form a magnificent avenue on "the Savannah" in Cayenne, French Guiana. It certainly is one of the loftiest of the family; and a variety denominated O. frigida is remarkable for the high elevation of its habitat above the sea, and was altogether unknown prior to the time of Humboldt's and Bonpland's travels in equinoctial America. The title, "cabbage," seems to be derived from the fact that the heart is often boiled, after the manner of this garden vegetable, and served upon the table; sometimes is made into pickles. It is possessed of many other economic values also. When the lower leaves drop, the broad part of the footstalk forms a hollow trough, frequently utilized as a cradle for their offspring by negro mothers; when cut up it makes excellent splints for the treatment of fractures; the inside of the green leaves, stripped off and dried, affords an excellent substitute for vellum, and the tender pellicle on the inside of the footstalks answers the purposes of writing paper; the pith makes a variety of sago. Finally, the wood of the trunk, which is very close and hard, split longitudinally, is extensively employed for gutters, but is too thin for any other purpose save, perhaps, the manufacture of canes.

Tropical foliage is always luxurious and rich, an ever increasing wonder to those living in temperate climes, as witness the scene taken from the Botanical Garden in Havana; but it is dark, and soon wearies the eye with its monotony of color. No such beautiful shades are seen as accrue to the maples, elms, and hickories of the North. But then everything is on so gigantic a scale, even to the creeping and running plants. Palm leaves ten, fifteen, even twenty feet in length are by no means uncommon; the leaves of other trees even exceed thirty feet, and the fact may not be generally known that it is the condensation of moisture upon the enormous foliage of the forest growth on the top of the Corcovado Mountain that supplies the city of Rio de Janeiro with potable water; from the leaves it drips into collecting basins, thence is carried to the consumers through the great aqueduct of Alcantara.

TYPICAL AVENUE OF THE ROYAL PALMS OF CUBA.



TROPICAL GROWTH IN THE BOTANICAL GARDEN, HAVANA.

A Unique College.

Two young Americans, Messrs. Vrooman and Baird, members of Oxford University, are inaugurating a scheme for the establishment of a college for labor leaders, and it is attracting considerable attention. The college is to be known as "Ruskin Hall," and it is said that the funds for the scheme are provided by the American admirers of Mr. Ruskin. The gentlemen we have named have leased Stebb's house, an old manse built in 1649, near Christ Church College, and it will be opened on Washington's Birthday by a meeting in the Oxford Town Hall. Ruskin Hall will accommodate forty men and some of the students will perform the work of the house, so that they will have their board free. The entire expense of the students' board, lodging, and tuition will be $5 apiece per week, and during the first two years fifty gratuitous tuitions will be given, and fifty students have already been selected for the first year. They are men who aspire to be vestrymen, County Councilors, members of Parliament, trade unionists, and men who harangue crowds in the streets and who organize clubs. This may be regarded as one of the most remarkable attempts toward the solution of sociological problems. There is no question that if labor leaders could once be educated so as to give them correct ideas of the great laws which make up political economy, they would be qualified to so lead the laboring men that there would be less misunderstanding and friction and the results would be highly beneficial, for in nearly every case it is the laboring man who suffers by disputes.

The Subway Explosion Verdict.

The first of the suits caused by the explosion in the Boston Subway, at the corner of Boylston and Tremont Streets, on March 4, 1897, was decided in the Superior Court of Boston on December 31, and it resulted in a verdict of $3,000 against the Boston Gas Company. The case began on November 9, and has occupied every court day from that time to the time of the decision, and is the longest trial on record in Boston. The amount involved was only $10,000, but the suit is regarded as quite important on account of the large number of other cases which are pending. There are more than seventy suits, in which damages aggregating probably $1,000,000 are claimed on account of deaths and injuries sustained in the explosion. We were fortunately able to obtain photographs taken in a very few minutes after the explosion, and these photographs are published in the SCIENTIFIC AMERICAN for March 20, 1897.

PROF. O. C. MARSH, of Yale University, one of the leading scientific men in America, has been honored by election as correspondent of the Academy of Sciences, at Paris.

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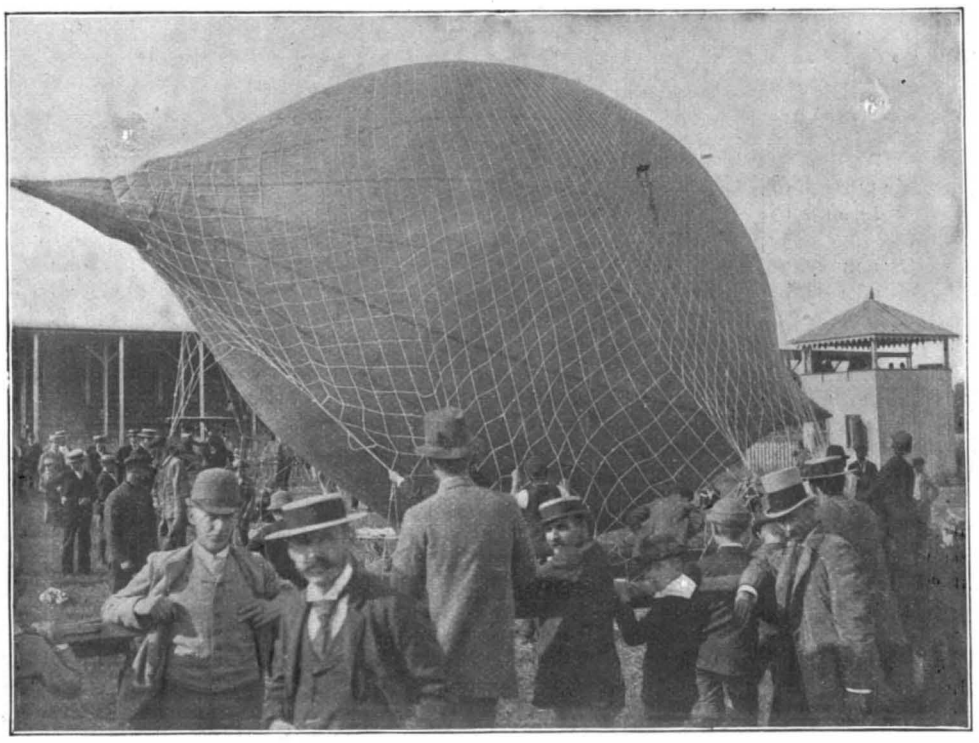
Taste and Smell.

While the physics of the senses of sight and hearing have attracted the attention of many philosophers, and have been elucidated by numerous ingeniously contrived experiments, those of taste and smell have been comparatively neglected. The very phraseology by which we are accustomed to describe the impressions which we receive through these portals of sense is indefinite, obscure, and uncertain. There are, indeed, several terms which would call up corresponding sensations in regard to the sense of taste, such as sweet, acid, alkaline, oily, and mawkish, but our vocabulary is small in calling up sensations of smell, and is almost limited to such general terms as pleasant and unpleasant, pungent and aromatic, fetid and fresh, which have none of the definiteness or precision that the terms blue or green possess in ordinary conversation or that the expression treble G gives to the musician. Our memory of odors is in general very imperfect. Attempts have been made, but not very successfully, to establish a gamut of odors, and it is difficult in many instances to dissociate the senses of smell and taste. Cuvier observed that these two senses are nearly allied to common sensation. In those animals which are only capable of breathing through the nose, like the horse, the extent of surface ministering to the sense

SPIRAL DESCENT OF THE "SKYCYCLE," SHOWING POSITION OF SCREW, SAIL, AND PLANES.

of smell is immense as compared with that of man. A large area of the nasal cavities is covered with mucous membrane which is thick in both, studded with numerous acinous glands, covered with stratified ciliated epithelium, supplied by the fifth pair of nerves, and is probably dedicated to other functions than those of smell, as, for example, the warming and moistening of the air, and its purification from dust before entry into the lungs, and a large portion also of the upper region seems merely to act as a periosteum to the frontal and ethmoidal cells, and to possess but a small share of special sensibility. The turbinal bone, on the other hand, the volutes of the ethmoid, and a considerable area of the septum between the nostrils, is covered with a thin, yellowish-red membrane, the epithelium of which is unprovided with cilia, to which the branches of the olfactory nerves are distributed, the ultimate fibrils being traceable to the very surface, covered only by a thin layer of fluid and being well placed therefore for the perception of delicate impressions. Common observation shows that while man is capable of perceiving a great variety of odors, many animals surpass him in the acuteness of their perceptions. The nature of these emanations probably varies considerably. Water, which has no smell to man, can be perceived by some animals at considerable distances. Sexual odors appear to be peculiarly expansive. Scarpa found that if he plunged his hand into water after handling a female toad, the males were attracted to him. Insects, and especially those of nocturnal habits, are guided to each other by their emanations. Judging from the actions of animals, the odors of plants are only in rare instances, as in the case of valerian by the cat, perceived or at least enjoyed by the carnivora. Putrid meat is devoured by the vulture and jackal, though it is not touched by many flesh-eating animals that feed on living prey, while it produces a kind of convulsion in many horses and madness in the bull.—Lancet.

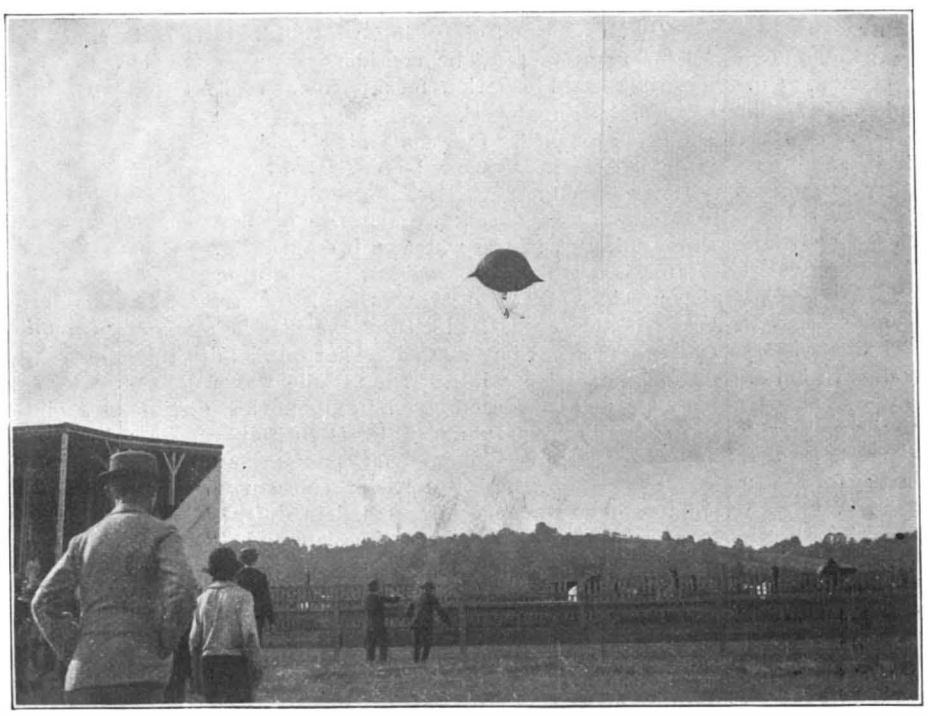


READY FOR THE ASCENT.

The Growth of Our Public Libraries.

The phenomenal increase in the growth of public libraries in the United States, which began some thirty years ago, continues to excite the surprise and interest of European students and statesmen, who regard such libraries an important adjunct to the American system of public education. Consul-General Du Bois, St. Gall, Switzerland, says that the United States is now teaching many useful things to the old world in the way of educational advancement and commercial progress, and now we are no longer regarded as a nation whose chief aim is the making of money, but are recognized as a potent element in the higher civilization.

The Swiss press frequently contains intelligent articles on our public school systems, colleges, universities, libraries, charitable institutions, etc. Albert Schinz writes in the Lausanne Bibliothèque Universelle et Revue Suisse that not only does the United States publicly contribute five times as much annually for public library purposes as does any other nation in the world, but it spends nearly as much annually for educational purposes as do England, France and Germany combined.



THE "SKYCYCLE" AT THE HEIGHT OF A QUARTER OF A MILE.

AIR SHIP EXPERIMENTS.

To the Editor of the SCIENTIFIC AMERICAN:

Interest excited by illustrations of Dr. Danilewsky's dirigible flying machine in SCIENTIFIC AMERICAN, December 31, 1898, may be increased by acquaintance with my experience with kindred apparatus extending over ten years in time and a large portion of the United States in space, the air vessel used being originally known as the gas kite and later as the "skycycle." The gas kite was a boat-shaped gas bag, inverted, as shown, while inflating, and floating with its flat deck surface acting as a kite drawn forward by a screw propeller, as shown in two other views.

The mechanism is shown in annexed engraving and consists of a bicycle seat, below which are foot cranks or pedals which connect by shaft and gearing with hand cranks, replacing the ordinary steering bar of a bicycle, so that the whole effective muscular effort of the rider may be conveyed to the screw shaft projecting forward to revolve a "screw sail," 15 feet in diameter. To permit of swifter revolution and avoid accidents in landing, this screw sail was later reduced to about 8 feet diameter. The gas vessel was next made more symmetrical by uniting two such vessels, deck to deck, forming a spindle, as in perspective view, showing the aerial torpedo about to be launched

OPERATOR'S SEAT AND PROPELLING MECHANISM.

skyward. In this form, with various propelling and steering appendages, it has now made flights over the States of Maine, New Hampshire, Massachusetts, Connecticut, New Jersey, Delaware, Maryland, Virginia, Ohio, Michigan, and Illinois, and over nearly every county in New York State, without injury to person or vessel. Unlike a gas balloon, it usually sails at a low level (though it has occasionally reached two miles elevation), and it is purposely balanced or weighted to come down if left to itself, only slight effort being necessary to keep it aloft, though speedy movement requires as much effort as to ride a bicycle up hill against a wind, and a more enduring and powerful motor than human muscles is desirable. Progress to right or left, up or down, or turning in a circle, is quite simple, and any movement or shift of the operator's position is responded to by reaction in the apparatus. A rudder attached behind the rider, and having a universal joint which permits fixing the rudder at any angle or in any plane, flat or perpendicular, aids guidance. Two of these, placed on each side of the operator, were afterward substituted, as shown above, and the rudder discarded. Various features were patented, when tests in midair showed their value. The complete apparatus, now in good order after

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much use each season for ten years, weighs as follows: Gas spindle, 56 pounds; bicycle seat, framework, and gearing, 15 pounds; screw propeller and rudder aeroplanes, 4½ pounds; netting, cordage, and anchor, 15½ pounds; total, 91 pounds. My weight is 115 pounds, making 206 pounds lifted, besides about 30 pounds sand ballast used to load the apparatus down. With such apparatus I have passed over a considerable portion of the Eastern and Middle States without reference to any weather, except rain and winter cold.

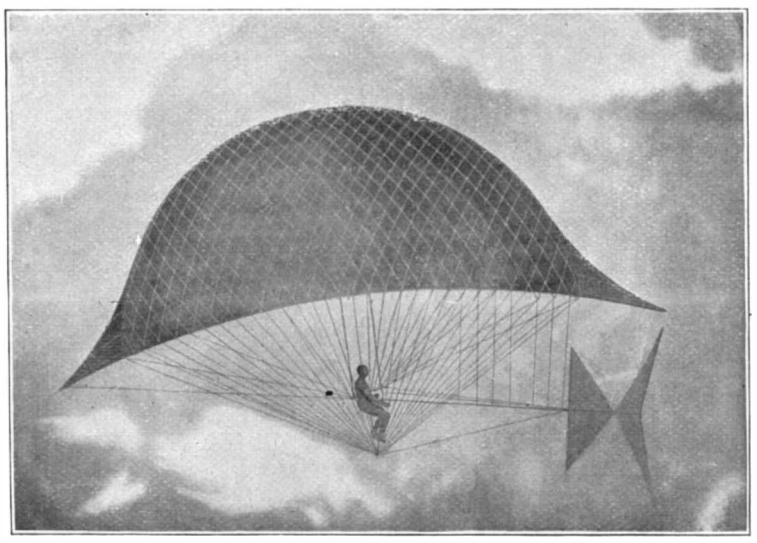
A kindred apparatus built by me, varying somewhat in weight, form, and dimensions, was operated several times by W. A. Barnard at the Nashville, Tenn., Exposition, 1897, inspiring many sensational and exaggerated newspaper accounts of its somewhat impossible performances. This apparatus was constructed for use with a two horse power motor, which was not applied there. This vessel had a cylindrical gas bag like Danilewsky's, but a sharper bow and stern. The stern of Danilewsky's, like the butt end of a projectile, is one of the worst possible forms for swift aerial movement, as it produces a suction behind which greatly retards it. I should not regard the apparent method of attachment—harness or netting—as safe under any other than the evidently pacific weather during which his experiments must have been made. The rigging should be such that under no circumstances of high wind or foul weather, whether in the air or anchored to earth, can the gas spindle escape from it. No mechanism is apparent whereby the vessel could be impelled backward or forward, or otherwise than up or down, except by inclining its body or steering by the rudder while rising and falling. The movement of a balanced gas vessel upward by muscular power is easy. I have jumped skyward thus a hundred or more feet, and have many times tossed a balloon and aeronaut skyward.

The movement of almost any form of gas bag through the air in any direction at slow or moderate speed with well-known appliances is an easy matter. Complete success in the art of aerial navigation is at present dependent upon the most approved features for propulsion and guidance, backed by a powerful light motor supported by a gas spindle of best form possible for speed and safety combined, which involves a strictly hydrogen-proof vessel incapable of flinching from the stress put upon it.

American invention is competent to create such appliances readily. The Patent Office shows some valuable features of this class, and our inventors' minds teem with aerial contrivances, only needing capital and construction to float them to success. Meanwhile "our doubts are traitors, and make us lose the good we oft might gain through fearing to attempt."

Air navigation is already at hand, if we but use the means at command.

Frankfort, N. Y. CARL E. MYERS.



THE GAS-KITE IN MID-AIR.

Artificial Eyes.

According to German authority, people wearing false eyes must be pretty nearly as common as the remainder of the victims collectively whom fate has deprived of a portion of their bodies, be it organ or limb. Every year, it is said, no fewer than 2,000,000 of glass eyes are manufactured in the German empire, and it is, of course, far from probable that the whole of the world's supply should be made in Germany. On the contrary, it is stated in La Médecine Moderne that a single French firm turns out at least 300,000 glass eyes annually, and that there are several other factories in France the output of which is about the same. How, it will naturally be asked, can this enormous stock be utilized? Glass eyes, although essentially brittle, are little liable to injury, do not wear out quickly, and are quite independent of the vagaries of fashion. Once suited, the owner of a glass eye may make it serve him a considerable time.

A writer in the Journal d'Hygiene is disposed to regard the oculiform millions as a fantastic creation, seeing that one-eyed people are rare comparatively speaking and that the majority of them do not wear false eyes; but a little consideration should suffice to show the critic that his doubts are not well founded. Like many an objector, he assumes the premises—to wit, that all the eyes are used to replace human losses, whereas most likely false eyes of every description are included in the list.

Evidently taxidermists, bird stuffers, the makers of wax figures, etc., must use an immense quantity, to say nothing of the artists who are responsible for the innumerable army of dolls large and small. Viewed in the light thus thrown upon the matter, the 2,000,000 which seemed to be so amazingly beyond the mark dwindle to a mere bagatelle—a mere drop, so to speak, in the ocean of false eyes. In this connection allusion to the singular fact that it is only the one-eyed who seek to conceal the deficiency by means of a substitute may be permissible. The totally blind never wear false eyes, or if an instance now and then occur, it merely serves to prove the rule. In consequence of his æsthetic sense a one-eyed man feels compelled to endure the discomfort which in greater or lesser degree attends upon any foreign body which has obtained lodgment in the human economy, but the man who has lost both his eyes is free from this weakness—his æsthetic sense expired along with his vision.—The Lancet, London.

Testing Purified Wool Fat.

Purified wool fat has in the course of the last few years become a favorite article as the body for salves and unguents, and continues to crowd out of use the former unreliable constituents used for salves. For this reason the governments of nearly all the civilized countries have prescribed the demands with which a purified wool fat has to comply. Although the German pharmacopœia has not yet incorporated such provisions, German druggists have felt the necessity of possessing a standard to which the fat shall conform, and some time ago the German Apothecaries' Society debated the matter and established rules for the purpose.

On page 12 of the second edition of the minutes of the Society the following style of testing is laid down, viz.: "When 50 grammes wool fat are with 300 grammes water heated in a retort to 100° C., and if then steam of a temperature of 100° C. is passed through the mixture, the parts first passing over by distillation must not contain alcohol, acetone, ether, or benzol." It is difficult to understand why only these and not the numerous other impurities should be ascertained. If an unalterable standard is to be established, it would be advisable to take cognizance of all the agents employed for extracting the fat. Before everything else it is also important to not only examine the distillate, but likewise the mixture of fat and water in the retort.

According to Dr. J. Lifschütz, the introduction of aqueous steam of 100° into a fat melted according to above prescription over water is an excellent and highly commendable criterion of the purity of the wool fat to be examined. While a well purified wool fat separates clearly and sharply by each manipulation, without any cloudy intermediate layer and with a lustrous plane of separation, from the water below it, this distinct separation does not at all take place with a fat that has either not been purified sufficiently or become partly decomposed in the process. On the contrary, a white, milky emulsion, that will not clarify even after long standing, will be formed underneath the fatty layer. This method of testing, which Lifschütz calls the "separation test," he considers to be by far the most important criterion for a purified wool fat that has remained unaltered.

When a purified, water-containing wool fat is to be examined, the process may be facilitated by dispensing with the introduction of steam into the water-containing fat. It is sufficient to melt this preparation for thirty minutes in the water bath over water. If the sample is a truly pure wool fat, the operator will notice, precisely as stated above, the distinct separation between anhydrous and clear, transparent fat and clear water free from fat, with a sharp and mirrorlike line of separation, while, if the sample was a defectively purified or decomposed product, this distinct separation between fat and water is entirely wanting; and also the upper layer of fat is not perfectly clear and transparent. This test has, in consequence of its eminent importance, been accepted in different pharmacopœias, for instance, the Russian and Austrian. If, however, an anhydrous wool fat is to be tested, the fat must first be emulsioned with 30 per cent water so as to obtain the water-containing fat, and this mixture must then be submitted to the test, or else, as above stated, steam must be passed through the fat above the water.

Lifschütz establishes the following rules for the purity of wool fat:

1. A well-purified and sound wool fat must not smell like the crude fat. Its consistency must be fatty, soft, and pliable, which properties it must also retain even after prolonged exposure to air. Should in this case its surface become pitchy and sticky, this condition may be regarded as the decomposition of the fat.

2. The wool fat must not turn darker subsequently when exposed to higher temperatures. To satisfy one's self whether the fat will do this, a sample is to be heated to 140° C. for thirty minutes, after which its color must not darken noticeably. Nor must it turn dark when exposed to daylight. Imperfectly purified wool fats are inclined to essentially change their color thereby, while a well purified article is rather apt to bleach than to darken; at any rate, it will remain unchanged.

3. Characteristic of an impure and deteriorated fat is also the reaction produced by concentrated sulphuric acid in a glacial acid solution of the fat. One-half gramme of the fat is boiled with 5 c. c. glacial acid, and 4 or 5 drops concentrated sulphuric acid are, after cooling and filtering, added to it. With a well purified fat, the solution will at best become slightly brown-yellow, while an impure preparation will, after thirty to fifty minutes, assume a full green color, and when examined in the spectroscope exhibit a vivid absorption band between the lines *C* and *d*.

4. An analysis for free fatty acids is performed in ethereal solution, not with normal potash, but with one-tenth normal potash. A good preparation must in the presence of phenolphthalein assume a permanent red colorization with one drop or two drops one-tenth normal potash.

5. An important indication is the above mentioned light and complete separation of the purified fat from the water incorporated with it. The water-containing preparation must, when warmed with the quintuple quantity water in the water bath, separate in short time into two clear and transparent layers. If the preparation is free from water, it must first be well rubbed together previously with about 30 per cent water. Much more characteristic and defined in both cases, however, is the above mentioned ready inclination to separate after the stirring of the wool fat with a hot jet of steam and subsequent standing at rest in the water bath.

6. When testing for freedom from ashes, the accidental residue must not only be examined for its alkalinity (with moist red litmus paper), but care must also be had that it contain no metals, such as lead, manganese, etc.

7. For proving manganese, the residue is melted with a little soda and saltpeter upon the platinum sheet. As is known, the fused mass turns intensively green in the presence of manganese.

8. For proving chlorine, a sample of the fat is boiled with absolute alcohol with the addition of one drop of diluted nitric acid and filtered perfectly clear after cooling. No opalization must show after an addition of a little alcoholic silver nitrate to this filtrate.—Pharmaceutische Zeitung, Berlin.

The Philadelphia Exposition.

The directors of the Philadelphia Exposition Association, of which Mr. P. A. B. Widener is president, have chosen Dr. W. P. Wilson to be the director-general. It was decided that the exposition should be opened about September 15 and closed about November 10. The national government has appropriated $300,000 for the exposition, contingent upon an equal amount being raised from other sources. This contingency fund is about complete, $200,000 being appropriated by the Philadelphia City Councils and $50,000 by the State Legislature; $50,000 has also been raised through private subscription. Plans for the work are now under way. It will be given under the auspices of the Commercial Museum, and it is thought probable that some of the buildings erected for the exposition will remain as permanent museum buildings. An additional appropriation of $50,000 has been made by Congress for the purchase of samples of foreign goods to enable domestic manufacturers to acquire knowledge of the kind of goods wanted by foreigners.

The Storage of Eggs.

An interesting experiment in egg storage was recently tried at Leith. In June a batch of 50,000 Scottish, Irish, and Danish eggs were sealed up in a storage apparatus, and were opened and examined four months afterward, and only a small proportion of the eggs were found unfit for use. In this method the eggs are kept cool and the air is allowed to have free access around each egg, which is kept in an upright position. The eggs are turned periodically, so that the yolk of the egg is constantly embedded in albumen. This is accomplished by placing the eggs in frames which, by the action of a lever, can be inclined in different directions as needed. In this way 23,000 eggs can be turned over in a minute without any chance of breakage.

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The Work of the School of Athens at Corinth.

Three years ago the Ephor-General of Antiquities, in Greece, granted to the American School at Athens the privilege of conducting excavations on the site of the ancient city of Corinth. The director of the school, Prof. Richardson, and his colleague for the year, Prof. Benjamin Ide Wheeler, of Cornell University, agreed, says The Tribune, that no valuable site in the kingdom promised more important results in excavations than this city, which in all Greece was second only to Athens in magnificence, wealth, and population, and had great historic interest. They were well aware of the magnitude of the task, for the ancient city was of very large size, and the ruins are also covered by a layer of earth from 15 to 20 feet thick.

The work in 1896 was of a tentative nature, as the topography was almost unknown, except the two harbors and the Isthmian sanctuary in the suburbs. Twenty trial trenches were dug, and the ancient Greek theater was discovered, with portions of a Roman theater resting upon it; also indications of the proximity of the Agora. In 1897 the work of excavation was interrupted by the war between Greece and Turkey. In 1898 excavations were continued with one hundred and twenty men, and were facilitated by the use of a track and twelve cars. The fountain Pirene, which was the center of the life of the ancient city, was one of the results of these excavations. They also discovered the lintel of the synagogue of the Jews, which, it is assumed, is the very synagogue in which St. Paul taught when he first came to Corinth. The American School has not money with which to continue the excavations at Corinth in the spring, and it will greatly be regretted if work must cease on account of a lack of a very few thousand dollars which is necessary to carry on the work.

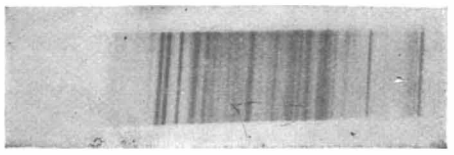
SIMPLIFIED APPARATUS FOR SPECTROSCOPIC PHOTOGRAPHY.

BY JOHN HELLYER WHITE.

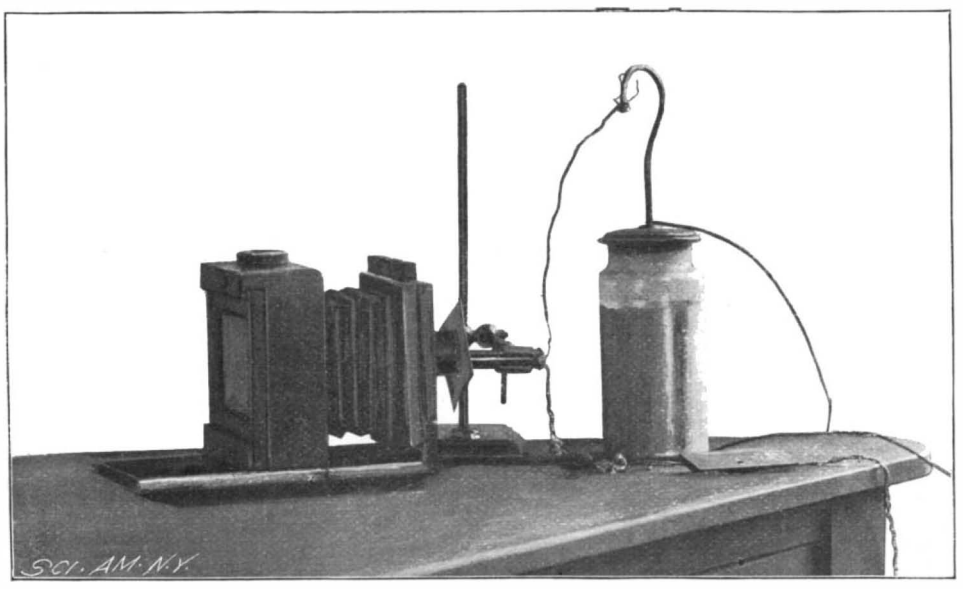
The spectroscope has always been an interesting but somewhat unfamiliar instrument to semi-scientific people, partly because of its expense and partly because of the care and skill that are required to use it successfully. I have made some experiments with apparatus that is very simple and have got very good results with it. It consists of only an ordinary 4×5 camera, a small Browning pocket spectroscope, and a stand to hold the spectroscope in place.

Nearly everybody has some sort of a camera, and the spectroscope would be the only extra expense. These small spectroscopes are manufactured by many optical firms, and a very good one can be obtained for ten dollars. With this apparatus I obtained a picture of the solar spectrum nearly three inches long, after an exposure of fifteen seconds. This showed an abundance of lines, the group about the "G" line being especially fine. On orthochromatic plates the exposure was doubled, but a negative was obtained that went from the invisible "M" line in the violet to the sodium "D" line in the yellow end of the spectrum.

The cut of the aluminum spectrum here shown was taken in the Jefferson Physical Laboratory with this apparatus. The accompanying engraving represents the camera with a movable ground glass screen. The spectroscope is at the front supported by a stand. In front of the tube is the source of light, either an electric arc or spark. Of course, when the sun is used for the light, other light is not needed, and the sun is focused on the adjustable slit of the spectroscope with a common double convex lens. Considerable care is needed to keep out all extra light from the plate, and for this purpose several pieces of the black paper that comes wrapped round plates were taken. Cutting a hole through them the size of the barrel of the spectroscope, pushing them up to the camera so that all the light was kept out, proved to be the best method, although black cloth can be used. The electrical apparatus used to take the aluminum spectrum was quite complicated, but before this I used simpler apparatus that is within the reach of everybody. For my spark I used a small induction coil that gave a spark half an inch long. This was operated by a plunge battery of moderate size. I used terminals of the metals I wished to photograph, condensing the spark by means of a small Leyden jar, which was insulated from the ground by a piece of glass, the outside of the jar being connected with one pole of the secondary of the coil and the inside with the other. This Leyden jar condensed the spark from one-half to about one-quarter of an inch, but it also made it very bright. The exposure needed on orthochromatic plates was about ten minutes. In the case of the spark spectrum, the spectroscope was put within three-fourths of an inch of the terminals, in order to get the necessary light. The extreme simplicity and smallness of this apparatus make it especially valuable where a larger apparatus cannot be used.



SPECTRUM OF ALUMINUM.

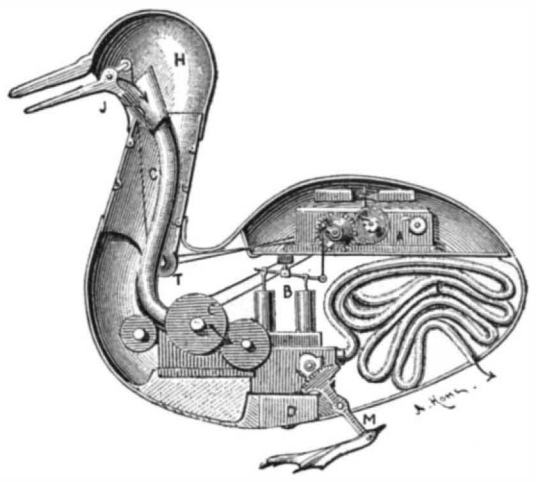


SIMPLE APPARATUS FOR PHOTOGRAPHING THE SPECTRUM

SOME CURIOUS AUTOMATA.

Of all the inventors of mechanical curiosities, Jacques Vaucanson was certainly the king. In the ingenuity of his mind he equaled, if he did not surpass, the most skillful of men.

In the first book of the Odes of Horace, we read that Archytas manufactured a wooden pigeon, which, actuated by a mechanical movement, flew from place to place. This, however, was nothing as compared with



INTERIOR OF VAUCANSON'S AUTOMATIC DUCK.

A, clockwork; *B*, pump; *C*, mill for grinding grain; *F*, intestinal tube; *J*, bill; *H*, head; *M*, feet.

the automatic fly manufactured by John Müller, and which flew around the table during a dinner, and alighted upon the hand of its owner and manufacturer, to the great astonishment of his guests.

Philippe Camus describes an extraordinary automatic group, which was specially constructed for the amusement of Louis XIV. It was a minute coach to which were harnessed several horses, and which rolled over the table. Upon starting, the coachman cracked his whip, and the horses began to prance and then became quiet and started off on a trot. The coach stopped in front of the king, and the lackey jumped from his seat, and, opening the door, handed out a handsomely dressed lady, who walked toward his majesty, saluted him ceremoniously, presented a petition to him, and then re entered the coach. The lackey closed the door and jumped upon his box, the whip snapped and the horses galloped off.

Vaucanson did better still. His automatic duck was, to connoisseurs, an object of admiration. The bird waddled off in search of food, and picked up and swallowed the seeds that it met with. These seeds, says an article in the Biographie Universelle, passed into the stomach through a series of triturations that facilitated the introduction of them into the intestines and caused them to accomplish all the phases of digestion.

It was impossible to distinguish this duck from a living one. It splashed about in the water and quacked at pleasure.

Vaucanson's mechanical flute player also was a marvel. It was a life-size figure clothed in the fashion of the period, and standing alongside of a broken column, upon which it slightly leaned. It was capable of playing a dozen different airs with remarkable ease. To effect this result, there was a system of weights that actuated a bellows placed in the interior of the automaton, and, through an invisible tube, forced air to the flute, where it acted in the usual way upon the stopple of the opening. In order to obtain the modulations, and, consequently, a complete air, the fingers of the automaton were movable and closed the holes of the flute hermetically when at rest, and also rose and replaced one another through the traction exerted by wires and cords that were tautened and relaxed by the play of a toothed cylinder.

About sixty years ago, a jeweler of Boulogne constructed a wonderful automatic prestidigitator. This figure, correctly dressed in black, performed various sleight-of-hand tricks with remarkable dexterity, and, when it was applauded, gracefully saluted the spectators to the right and left. One of its tricks was the following: It struck a table several times and made an egg come out of it. It then blew upon the latter, when out of it came a bird that flapped its wings and sang, and afterward entered the egg again. This trick finished the exhibition.—Lectures pour Tous.

Queen Victoria's Yacht.

The new royal yacht for the Queen of England was commenced on December 23, 1897, when the first keel plate was laid at the government dockyard at Pembroke. The name for the new yacht has not been chosen as yet, and the Admiralty have not, until recently, given out any particulars of the new vessel; but now, however, they have done so. The new yacht will be 380 feet long; her beam is 45 feet; the draught is to be 18 feet, and her displacement is to be 4,600 tons.

It will be seen that this yacht is much larger than W. K. Vanderbilt's yacht "Valiant." The new royal yacht is as large as the cruiser "Baltimore," larger than the "New Orleans," and much larger than the "Hohenzollern," the German Emperor's yacht. The latter boat is really nothing more than a cruiser, with apartments for the Emperor. The new royal yacht will be a yacht pure and simple. The hull is to be steel sheathed with wood and covered with copper. She will have three funnels and two masts; her twin screws will be driven by triple-expansion engines; steam will be supplied by eighteen Belleville boilers, which will work at a pressure of 300 pounds, which will be reduced at the engines to 250. It is expected that the yacht will be driven at a speed of 20 knots an hour with the engines making 140 revolutions a minute. It is expected that the new vessel will cost in round numbers about $1,500,000.

The Current Supplement.

This week's number of the SUPPLEMENT, No. 1203, contains a large portrait of the much-talked-of Dowager Empress of China. Prof. Lewes has a popular and valuable article on Acetylene, giving all the information that has been obtained up to date regarding this peculiar gas. There are several illustrations of interesting electric motors, and an illustration of a compound French locomotive of high speed. An account of the construction of the Gatling cast steel gun and an explanation of the test recently given, by Mr. Gatling himself, is of interest. There is a striking illustration of the new artists' Vienna Exhibition building. An illustrated article on Archæological Museums explains the best mode of lighting exhibits. There is an extensive report of the recent meeting of the Geological Society of America, as well as the report of an interesting lecture on the "Diseases of Nations," which describes rather fully the causes at work tending to their ultimate downfall. The "Evolution of the Song Bird" is treated at length, and interesting illustrated articles on the "Utilization of Unio Shells for Buttons" and on "The Principles and Practice of Bulb Growing" are of present practical value. There are also the usual notes on electrical, railway and engineering matters and useful formulæ.

Contents.

(Illustrated articles are marked with an asterisk.)

Air ship, experiments with*..... 41
Automata, some curious*..... 43
Beet sugar industry in New York State*..... 36
Bible, another Gutenberg, sold... 38
Botanical gardens, work on..... 39
College, a unique..... 40
Commercial enterprises, shall government engage in?..... 34
Corinth, work of school of Athens at..... 43
Diamond reef shoal in New York Harbor..... 34
Eggs, storage of..... 42
Explosion, verdict on subway.... 40
Exposition, the Philadelphia..... 42
Eyes, artificial..... 42
Fire and modern skyscrapers..... 39
Fulton and steamboat*..... 37
Guns at Washington Arsenal*.... 36
Hospital for animals, Indian 38
Inventions recently patented..... 44
Libraries, growth of..... 41
Lightning, curious freaks of..... 45
Lightning rod of St. Peter's, repairing..... 35
Nations, diseases of..... 34
Palms of Cuba*..... 40
Patent laws, needed amendment 34
Photography, simplified apparatus for spectroscopic*..... 43
Sights and range finders for coast defense guns..... 39
Smell and taste..... 41
Steamboat, Robert Fulton and*.. 37
Taste and smell..... 41
Trade marks, diligence required from owners of..... 35
Vehicles, horseless..... 39
Weeds, edible..... 35
Wool fat, testing pure..... 42
Yacht, Queen Victoria's..... 43

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RECENTLY PATENTED INVENTIONS.

Bicycle-Appliances.

CHAIN-CLEANER.—JOSEPH C. CONN, Ilion, N. Y. The chain-cleaning mechanism comprises a base surmounted by an adjustable standard carrying brushes upon which standard a wheel is mounted. A well in the lower part of the device is adapted to contain a cleaning material, such as gasolene. The chain after having been removed from the wheel, has its ends united and is then hung upon the wheel, with one side between the brushes. The wheel is then turned, and the chain passed through the brushes and the gasolene. After having been thoroughly cleaned, the gasolene-well is removed, and an oil-well substituted. The chain is then again passed through the well and thus thoroughly lubricated.

Engineering Improvements.

STEAM-BOILER.—BENJAMIN T. STAUBER, Jewell, Kan. This steam-boiler has both an inner and an outer shell; the inner shell is entirely open at the bottom and is designed to collect the steam. The space between the inner and outer shells is filled with water. The inventor claims for his boiler an ability to raise steam rapidly and to make large and rapid increase or reductions of steam without blowing off.

Mechanical Devices.

ROPE-MEASURING MACHINE.—HUDSON G. CHILTON, Canton, Miss. To indicate the length of rope, cord, wire, automatically, while running off from a coil, a machine has been devised consisting of a frame to which a standard is vertically secured; a grooved measuring-wheel which has a face-pin, and which is journaled on the upper end of the standard; a toothed and numbered slide vertically arranged and movably and elastically held in guides on the standard adjacent to the wheel, its toothed side being adapted for engagement with the pin of the wheel, as the pin revolves around the journal; and a spring to hold the slide in any adjustment. The length of the wheel-periphery being known, each rotation of the wheel caused by paying off the rope will be indicated by adjusting the slide one tooth higher, and the numeral shown on the slide above the top of the standard will indicate the number of rotations and hence the length of rope.

ORE-GRINDER AND AMALGAMATOR.—JACOB GERSTLE, Portland, Ore. The pan-bottom of this ore-grinder is curved in section, so that the pulp gravitates to the middle line between the grinding surfaces. In order that the pulp may be kept in motion so as to come under the shoes and into contact with the quicksilver, plowshare-like scrapers are provided for each shoe, one of which scrapers loosens and brings down the pulp that generally collects near the center of the pan and around the middle of the hub, and the other one of which draws the pulp back from the outer edge of the pan. The shoe-arm is yieldingly constructed and made to drag, thus allowing the shoes to be used until quite thin and obviating the necessity of constantly substituting others. The dies form a detachable bottom to the pan and are seated in recesses with their upper faces flush with the curved bottom. They are so joined that a section may be removed at one time, in order to facilitate cleaning.

RAZOR STROPPING AND HONING APPARATUS.—JOHN A. PLATT and FERNANDO C. DOS PASSOS, Augusta, Ga. In this apparatus for sharpening razors, the blade is securely held, so that its edges are subjected to the sharpening action of parallel rollers, each provided with a spirally-arranged leaf of leather for stropping the blade. The rollers are driven by gearing through the medium of a crank.

WIRE-STRETCHER.—SPENCER S. SANDERS, Hemlock, Ohio. On the frame of this wire-stretcher a nut moves in guides and is engaged by a screw. Tongs grip the wire. Connections between the nut and the two arms of the tongs are provided whereby, when the nut is moved in one direction, the tongs will be tightened on the wire, and when the nut is moved in the opposite direction, the tongs will be released from the wire.

BENDING-MACHINE.—CHARLES SEYMOUR, Defiance, Ohio. This invention is an improvement in bending-machines, and is more especially designed to provide a means for bending wagon and carriage fellies and the like. Upon the frame of the machine swinging, connected bending-arms are mounted, which carry a master-strap superposed by a minor strap for receiving the straight timber to be bent. On the main frame is arranged a form having a segmental rim and inclined guideways and movable rim sections at the ends of the form-rim, sliding in the guideways. The peculiar construction of the form enables the bent timber to be conveniently removed.

MOTOR.—CARROLL M. BELL, Greencastle, Ind. To provide a simple motor, arranged to utilize the motive agent to the greatest profit, and designed to drive various machinery and to act as an air or water pump, are the purposes of this invention. The motor comprises wheels in mesh with each other; weighted arms carried on the peripheries of the wheels; and mechanism for giving the weighted arms a movement in opposite directions. The arms are adapted to operate pumping machinery carried by the wheels.

Railway-Contrivances.

RAIL AND TIE PLATE.—JOSEPH F. DIONNE and JOSEPH A. GUY, Edmundston, Canada. The object of this invention is to provide a tie-plate which is cheap and which will firmly hold the spikes in position, and thus perfectly maintain the gage of the rails. The plate has a flat body provided with portions at two diagonally opposite corners offset or bent upward to cover the spike-heads, these portions opening oppositely toward the sides of the plate. Notches in the corners of the plate receive locking spikes.

MEANS FOR ALTERING GAGES OF RAILWAY ROLLING-STOCK.—LOUIS PEARCE, Fremantle, Western Australia. This invention seeks to provide means whereby the difficulties incidental to the various breaks of railway-gages may be overcome, so that the same rolling-stock may be used on all lines, even though of different gage. With these ends in view, the inventor forms a screw-thread on the axle and a corresponding screw in the eye or boss of the wheel. To retain the wheels upon the axle in their correct positions, distance-collars are employed, which may be changed in position to comply with different gages. Underneath the carriage-floor, hinged pawls are suspended, which prevent the axle's turning during the time the wheels are being screwed outwardly or inwardly on the axle, and which engage ratchets on the axle. These pawls securely hold the axle in place.

Electrical Contrivances.

ELECTRIC PROPULSION FOR VEHICLES.—FRIEDRICH W. SCHNEIDER, Triberg, Germany. In this improvement for the propulsion of vehicles by accumulators, a main battery when starting is put in circuit parallel with a small auxiliary battery, constructed for quick discharge, the purpose being to supply the additional current required at the start essentially from the auxiliary battery, thus avoiding a high rate of discharge from the main battery and thus increasing the efficiency of the battery. By this construction the inventor avoids the excessive discharge incidental to the use of the mixed system of accumulators.

ELECTRIC SWITCH.—OSCAR H. SCHUCK, Philadelphia, Penn. In the ordinary arrangement of door-alarms, a switch is placed in the circuit near the door, which switch may be turned to break the circuit when it is desired that the door shall remain open without ringing the bell. It sometimes happens that such switches are carelessly left open when the door is closed, thus rendering the alarm inoperative. In order to overcome the difficulty, this invention provides a switch having a spring normally holding the switch-arm in connection with the contact-brush. At the free end of the switch-arm a lug is located. A lug on a spring-pressed sliding plate is designed to engage the arm-lug in order to hold the arm in open position when the door is open. Upon closing the door the plate, acting through the medium of the lugs, causes the switch to return to its circuit-closing position.

Miscellaneous Inventions.

SINGLETREE-HOOK.—ARTHUR R. SULLIVAN, Rome, Ga. The hook is provided with a pivoted link or bar. When the hook gravitates to a vertical position, the link gravitates to a similar position directly across the mouth of the hook, and is locked there against lateral displacement by an inturned link on the hook. In this position the hook is closed, and the trace-chain cannot become displaced.

REVOLVING SHOW-CASE.—ROBERT W. LEVITT and CHARLES W. HUNT, Somerset, Ohio. The purpose of this invention is to provide a revolving show-case which can be readily cleaned. With this end in view, the show-case is made with a series of detachable compartments, any one of which can be taken out, cleaned and refilled, without disturbing the rest of the case. The case operates on the general principle of a central standard, turning in a seat or step bearing in a base.

ACETYLENE GAS GENERATOR.—JACOB L. GEBHART, Hot Springs, Ark. This generator consists of a carbid-chamber, a generating tank communicating with an external float-tank, and a gasometer. A float within the float-tank is connected by rods and levers with the valve of the carbid-chamber, and its position depends upon the pressure of gas in the generator. When this pressure sinks, the float descends and causes the valve of the carbid-chamber to open, in order that a quantity of carbid may fall into the generator. When the pressure becomes excessive, the float rises and stops the further generation of gas. The apparatus has been so constructed that it will comply with the demands of the insurance companies.

METHOD OF AND APPARATUS FOR EXTRACTING BITUMEN FROM SAND.—AUGUSTUS S. COOPER, San Francisco, Cal. In various parts of the United States large quantities of sand, the grains of which are cemented together by bitumen, are found. The principal object of the present invention is to obtain this bitumen free from impurities at a low cost. The method employed consists in subjecting the material to crude petroleum in order to dissolve the bitumen, in subjecting the mass to the action of a benzin solvent for the bitumen, in mechanically agitating the mass, separating the solution from the sand, evaporating the solvent from the asphalt and returning the solvent in vaporized form to fresh portions of the oiled sands.

HOLDER FOR FLY-PAPER.—CHARLES F. FERNALD and FRANK J. KARTEN, Santa Paula, Cal. The holder comprises a base-plate, upon which a standard is mounted. Upon the standard a top plate slides. Between the plates the fly-paper is held. The top-plate may be lifted off the standard and the fly-paper bent into the form of a tube and secured at its edges by pins. The holder may be suspended from the ceiling by a string or wire.

DEVICE FOR USE IN WRITING.—EDWARD H. LANIER, 530 Walnut St., Cincinnati, Ohio. This device is intended to be worn on the hand for the purpose of securing a proper position of the thumb in writing. As the correct position of the thumb in a measure insures the correct position of the fingers, the device thus operates to attain a correct position of the hand. The device comprises a bow having its bore formed to correspond with the correct bend of the thumb, and an adjustable connection for the free ends of the bow.

TIRE-HEATER.—EDWARD G. FERGUSON and JOHN P. HOLMEN, Kensett, Iowa. The tire-heater has an annular heating-chamber and doors to open and close the front face thereof. To a central vertical frame-bar attached to the back, a bracket-bar is secured with its body parallel therewith and extending across the upper portion of the annular chamber. Tire-supporting pins or rollers are journaled in the frame and bracket-bar and extend across the heating chamber. Intermeshing gears upon the pins or rollers enable all the pins or rollers to be simultaneously revolved.

NECK-YOKE.—CYRUS COOPER, Tiverton, Ohio. The neck-yoke is designed to be attached to the poles of two-horse vehicles, and is constructed so that it can be readily connected with and disconnected from a notched head formed on a block swinging in the pole. The construction prevents the accidental displacement of the yoke.

CLOTHES LINE TROLLEY.—ELLA GILON, New York city. This invention seeks to provide a trolley which can be applied to a line in order to support the lower run thereof from the upper run, and at the same time permit an easy manipulation of the line. The trolley comprises a frame made of a single piece of wire, which frame has its lower portion formed into a loop for the reception of the lower run of the line. One member of the loop extends diagonally, with the ends of the frame terminating at the diagonal member. The pulley is journaled in the upper portion of the frame.

WAGON.—CHARLES W. HEMM, Kendall, Ill. An ordinary farm-wagon, by means of this inventor's device, can be transformed into a hay-wagon. The device is a fixture having a body-portion adapted to lie vertically against the side beam of the wagon. A head at the upper end of the body-portion extends transversely thereto to project over the top of the wagon-beam. Two perpendicular flanges stand on the head and carry a cross-bar.

DOOR-CLOSER.—DENIS HOGAN, 682 Marcy Avenue, and FRANK MCMAHON, 947 De Kalb Avenue, Brooklyn, New York city. The purpose of this invention is to provide a door with means whereby it can be readily swung in and out; and whereby on its release from either position it may swing automatically into a closed position without the use of expensive double hinges. The door has a bearing in the form of two pulleys spaced apart and journaled in the top of the door. A rope passes over the pulleys and is weighted at one end. The weight rises and falls in a bore in the door. A pin secured to the door-frame is engaged by the outer end of the flexible connection. When the door is swung, the pulleys in moving with the door engage the rope. As the rope is fastened to the pin, the weight is drawn up by the action of the corresponding pulley. When the door is released, the weight closes the door.

BRACKET.—FRED S. JEWETT, Laconia, N. H. This bracket, designed to be applied to a window-frame so that a shelf may be removably held and adjusted, has a body-plate, the upper portion of which is provided with a vertically-extending slot having an enlarged lower end, and with a notch extending to the upper edge of the body-plate. Horizontal flanges secured to the lower portion of the body-plate receive between them a shelf. A transverse lip is attached to the outer edge of the body-plate and engages the front of the window-frame.

THAWING-APPARATUS.—RAYMOND A. LACKMAN, Earling, Iowa. In order readily to thaw frost in the ground, this inventor has devised a heater mounted on a sled, the top of which is formed like a grate. A hinged front door and a rear door are provided for the heater. A boiler is mounted on the heater, and the steam generated therein is conveyed to a hollow ground-boring tool by means of a flexible pipe.

VEHICLE.—JOHN LINDSEY, Sandersville, Miss. To provide a vehicle especially adapted for hauling logs, this inventor has devised a wagon so constructed that the trucks will be enabled to yield vertically and laterally without losing in stability or strength. The vehicle consists of pivotally connected trucks, each of which comprises a frame with which axles are loosely connected, whereby the frame is capable of movement upon the axles; a reach having rocking movement upon the axle; and a bolster mounted to rock upon the frame and reach, whereby the bolster is enabled to move vertically on the frame.

BUCKLE.—JACOB POLKA, Smith Centre, Kan. This buckle is especially designed to be used on traces, the construction being such as to permit the trace to be held firmly and securely without injury. The buckle has a main frame, a tongue-frame mounted removably on the main frame, a tongue carried by the tongue-frame, and coacting therewith, and a spring attached to the main frame and engaging the outer end of the tongue in order removably to hold the tongue.

FASTENING FOR FLOOR-COVERINGS.—JAMES K. THOMA, Winfield, Kan. To provide an improved means for holding down carpets, oil-cloths, and the like, this inventor has devised a fastener provided with a base-plate having at one end an upwardly-extending flange, on which is pivoted a top plate, between which and the base-plate, the floor-covering is passed and held in place. Spikes extend down from the base-plate and are adapted to be driven into the floor so as to secure the fastener in place. Pins on the base-plate pass through the covering and hold it on the fastener.

TOOL-HANDLE.—JACOB TVEIT, Stoddard, and OLE OVERSEN, La Crosse, Wis. The handle provided by these inventors is designed to fit hoes, rakes, forks, and the like, so that the tool held can be readily removed and can be adjusted either vertically or laterally. The handle has a bifurcated shank, the members of which are provided with opposing socket-faces adapted to receive between them a ball connected with the tool. A bolt passes loosely through the members of the shank and is provided with a head at one end and a nut on the opposite end, in order to clamp the ball in place. A lever is pivoted on the shank at the rear of the bolt, and by its means the ball is more securely clamped between the shank-portions.

MAGAZINE CAMERA.—ANDREA ANGEL, Liverpool, England. This invention provides improvements in cameras in which are used a series of sensitized films separated by backing-cards alternated with the films in the usual manner. The invention consists principally of mechanism whereby the films are prevented from buckling and are held perfectly flat during exposure, and whereby the release of the films in succession and the disposal of the exposed films and their backing-cards are effected. A special object of the invention is to dispense with notching the films, or otherwise adapting them for the action of the releasing mechanism.

GRID FOR COTTON-GINS.—MANCHERSHAH DORABJI DAROOVALA, Bombay, India. In the present gins used in India, the fingers of the fixed grids are merely plain fingers attached to a base-plate, and the outer ends of the fingers are in no way secured from movement. As a result, small stones or other obstructions, during the process of ginning, very often bend the fingers and destroy the equal spaces between them. To overcome this difficulty, the inventor of the present grid employs a strap rigidly connected with the outer end of its fingers, the top of the strap being inclined downwardly and rearwardly. A moving grid co-operates with the fixed grid.

METHOD OF AND DEVICE FOR PRESERVING FRUIT FROM DAMAGE DURING SHIPMENT.—SILAS R. DIVINE, Loch Sheldrake, N. Y. In order to preserve strawberries and other fruit during transportation, this inventor provides a method of packing fruit which consists in embedding each stem, calyx, or cap of the fruit in a plastic compound (such as plaster-of-Paris or sugar) capable of hardening. With such a method of packing, the fruit will not be dislodged under ordinary conditions.

PROCESS OF TREATING BLAST-FURNACE SLAG FOR CEMENT.—ALEXANDER D. ELBERS, Hoboken, N. J. To adapt slag for use as a silicifying ingredient for hydraulic cements, a method has been devised which consists in superficially desulfurizing pulverized blast-furnace slag by a weak solution of nitric acid, and in rendering alkaline the superficially-desulfurized slag by impregnating it with a solution of sodium carbonate.

SHIRT.—BENNETT BERNSTEIN, New York city. To make a shirt as economically as possible, and, at the same time, to reinforce the material and thus produce a durable garment, are the purposes of this invention. The shirt has a body across the back of which a sleeve-back section extends, is fastened, and has its end portions projected beyond the body to form the backs of the sleeves. Two sleeve-sections joined to the edges of the ends of the sleeve-back sections have their inner ends overlapping the body edges at the armholes to reinforce the body at these points. The sleeve-front sections terminate at each side of the throat.

Designs.

WALL-PAPER.—CHARLES RUFFLY, Rixheim, Germany. This design consists in a bouquet of flowers and foliage, in the composition of which a group of hibisci, gloxinia, and achimenes flowers, together with foliage and sprays, constitutes the body-portion of the bouquet. From the body-portions morning-glory vines trail down.

BORDER FOR WALL-PAPER.—CHARLES RUFFLY, Rixheim, Germany. The leading feature of this design consists in a festooned fabric and bunches of flowers at the ends of the festoon.

DOCTOR-BLADE FOR PRINTING-PRESSES.—GEORGE UDELL, Providence, R. I. Doctor-blades, when forced into their holders, frequently become convex in form at their edges, thereby considerably impairing the efficiency of the blade. This design provides a blade concave in form at its edges, so that the blade when forced into its holder assumes a straight edge.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

RIVERS OF NORTH AMERICA. A Reading Lesson for Students of Geography and Geology. By Israel C. Russell. New York: G. P. Putnam's Sons. London: John Murray. 1898. Pp. xv, 327.

This is an admirable book and is filled with valuable and reliable information which is told in a popular manner without destroying its scientific value. If students would read books of this nature, it is certain that the science of physical geology and physical geography would take on a new meaning for them. We now have works which compare with this one on volcanoes, earthquakes, oceans, earth-sculpture, etc., and all students in our colleges and scientific schools should be required to read at least half a dozen good books on the various subjects noted. The present volume is admirably illustrated and the bibliographical references are excellent.

CORONA AND "CORONET." By Mabel Loomis Todd. With illustrations. Boston and New York: Houghton, Mifflin & Company. Cambridge: The Riverside Press. 1898. Pp. 383. Price $2.50.

The present volume is a narrative of the Amherst eclipse expedition to Japan in Mr. James' schooner yacht "Coronet," to observe the sun's total obscuration, August 9, 1896. It is a tasteful volume dealing with the events of the trip. The volume is most interesting and will appeal to all who care for unconventional traveling. It should not be supposed that it is interesting only to the scientist. On the contrary, it appeals to the general reader and will be a welcome addition to any library. The illustrations which fill it are excellent and have considerable scientific value.

DIE TINTEN-FABRIKATION. Von Sigmund Lehner. With three illustrations. Vienna: A. Hartleben. Pp. 245. 8vo. Price, paper, 90 cents.

Sigmund Lehner's work needs no introduction to the maker of inks; for the four editions through which the work has already passed have long been favorably regarded by every maker of writing-fluids. In the present fifth edition of this monograph on the manufacture of inks the author has thoroughly revised his work, and added many formulæ. The directions given and the processes described are the result of careful experiment on the part of the author, so that any one who carefully follows the directions given and employs pure materials should obtain good results.

STEAM NAVIGATION. By James Croil. Montreal. With illustrations and portraits. Toronto: William Briggs. Montreal: The Montreal News Company, Limited. 1898. Price $1.50.

This volume is a decided addition to the literature on this ever popular subject. The historical work is particularly good, the most essential links in the history of steam navigation being pieced together in some very readable chapters. The author is well qualified to speak of pioneer days, for he introduces some personal reminiscences of a voyage made in a sailing vessel fifty-seven years ago. The time, forty-two days, was "excellent," being faster by two days than the time of the "packet-ship," the latter being the equivalent of the express steamship of the present day. It is shown that the paddle

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wheel antedated the steam engine, being driven by horse power variously applied. Denis Papin is given credit for the first steamboat, and the Scotchmen Miller and Symington are duly recognized as having built steamboats in 1788 and 1802. Fulton's "Clermont" on the Hudson River and Bell's "Comet" on the Clyde are shown and described, the description, by the way, being much superior to the woodcuts. The whole of the book is freely illustrated with woodcuts and half tone engravings of the various notable steamships of the age. The great steamship companies are taken up in their order, a brief sketch of the origin of each being followed by a description of the leading vessels. Portraits of the founders and chief promoters of the various companies accompany the various chapters. Particular attention is given to the development of steam-navigation on the great lakes. The text is written in a clear, concise style, well adapted to the subject.

GRAMMAIRE FRANÇAISE. By Baptiste Méras and Sigmon M. Stern. New York and Chicago: Henry Holt & Company. 1898. Pp. 312. 12mo. Price, cloth, $1.25.

FIRST LESSONS IN GERMAN. By Sigmon M. Stern. New York and Chicago: Henry Holt & Company. 1898. Pp. 292. 12mo. Price, cloth, $1.

FIRST LESSONS IN FRENCH. By Baptiste Méras and Sigmon M. Stern. New York and Chicago. Henry Holt & Company. 1898. Pp. 321. 12mo. Price, cloth, $1.

Perhaps there is no branch of pedagogy which has witnessed such remarkable changes in method within so brief a period as the teaching of modern languages. Prominent among the institutions in the United States which have introduced the new analytic method of teaching a foreign tongue may be mentioned the Stern School of Languages, in New York city. The three volumes which lie before us embody the principles of teaching which have earned for this institution an enviable position among language-schools.

In the "First Lessons" in German and French the foreign language is directly taught without the assistance of the native tongue, and, at first, without the intervention of grammatical rules. The language is learned by imitation and by constant use of the idiomatic forms brought forth in each lesson. Grammar is learned by induction, not by the memorizing of long rules and the innumerable exceptions to those rules. In the "First Lessons" the chapters are divided into a language division, oral exercises, grammatical exercises, and "Woerterklaerungen" in the German book, "Explication de mots" in the French book. For Americans who are not as yet familiar with either language, the "First Lessons" will be of immense service in acquiring that much desired familiarity.

Of the little Grammaire Française, written primarily for those having an elementary knowledge of French, much can be said in praise. Its information is presented so attractively, and its explanations are so clear and concise, that no difficulty should be experienced in studying a subject usually presented in a form repugnant to the average student.

ARMAGEDDON: A TALE OF LOVE, WAR, AND INVENTION. By Stanley Waterloo. New York: Rand, McNally & Company. 1898. Pp. 259. Price, cloth, $1.

Armageddon was the famous battlefield of the Hebrews, upon which, thousands of years after, Napoleon gained a victory over the Turks. The author of "The Story of Ab" lets his imagination travel through the first years of the coming century and gives a vivid picture of the conditions of the world, especially as regarding love, war, and invention. One of his characters invents an airship from which missiles can be thrown that end a war at once. The special interest centers in the reasons for an Anglo-American, in fact, an Anglo-Saxon alliance. A detailed description is also given of the working of a Nicaraguan canal by English and American money and engineers.

THE METRIC SYSTEM OF WEIGHTS AND MEASURES. Hartford, Conn.: Issued by the Hartford Steam Boiler Inspection and Insurance Company. 1898. Pp. 196. Tables. Price $1.25.

This little volume is convenient in size for the pocket and for general reference. It is printed on excellent paper with red edges and is bound in sheepskin with the title in gold. It is a very neat little volume and should command a considerable sale, as it contains everything that a more expensive book would have. The metric system is now so universally employed in foreign books and periodicals that much time is consumed by the American reader in transferring these units into their English and American equivalents; therefore a work of this kind will facilitate comparisons and enable the reader to work out problems, calling for the use of the metric system, in the shortest possible space of time. The first part of the book is devoted to the history of the metric system. This is the best history of the system that we have seen. We hope the time will soon come when the metric system will be compulsory in the United States. When its use has become obligatory, it will undoubtedly work a hardship to some, but in the end it will prove of great benefit to everyone, and the amount of time which it will save will be simply incredible.

PRACTICAL CARRIAGE AND WAGON PAINTING. By M. C. Hillick. Chicago, Ill.: Western Painter. 1898. Pp. 161. 8vo. Price $1.

This work is a full treatise on the painting of carriages, wagons, and sleighs, by a thoroughly practical man. The work embraces full and explicit directions for executing all classes of work, including painting, factory work, lettering, scouring, ornamenting, finishing, etc., with many tested receipts and formulas. The value of a tested formula cannot be overestimated. While we are not familiar with the subject of the book ourselves, we can judge the book sufficiently to say that it is a thoroughly practical and up-to-date book which no carriage painter should be without.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Wanted made on royalty, Vehicle Tire illustrated on p. 421, Dec. 31, 1898, issue. O. Ramsey, El Campo, Texas.

Wanted—Capital to introduce Automatic Fly Trap. Application granted December 3, 1898. Immense sale assured. M. S. Featherstone, Goshen, California.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7558) R. J. S. asks: Which is the better—Toepler-Holtz or Wimshurst machine? A. It is difficult to say which is the better, a Holtz or a Wimshurst machine. Both are good. The Wimshurst is the simpler machine. It is described in SCIENTIFIC AMERICAN SUPPLEMENTS 584, 647, 914, 948. Price 10 cents each, by mail. The Holtz machine is described in SUPPLEMENT, Nos. 278, 279, and 282. Price 10 cents each, by mail.

(7559) J. B. R. says: There is a paint made of coal tar which is a good paint for iron, tin, and felt roofs. Can you give me any information as to its good or bad qualities, or the effect it has on metal roofs? I would like you to give me the formula for making such paint out of coal tar. I want to manufacture and use such paint. A. After the paper is put on take coal tar and lime (burnt, but not slaked), boil them together in the proprotion of 15 lb. lime to 100 lb. tar. Put it on hot. To avoid the tar boiling over, stir the lime in the boiling tar very slowly. The mixture must always be heated before putting on. The lime and tar form a chemical connection, which is fireproof, cannot be melted by sun heat or dissolved by steam or hot water, and makes a smooth, glazed roof.

(7560) C. P. E. asks: What strength of current is required to light one 16-candle power incandescent light, and what is the most economical chemical battery which will furnish the required current? A. 16-candle power lamps are made for 50 to 110 volts. No primary battery gives as much pressure as 2 volts per cell; hence about 30 cells will be required to run a 50 volt lamp. The cost of such a battery and the labor of cleaning and recharging it frequently entirely prevents any use of batteries for lighting so large a lamp.

(7561) H. L. B. writes: I have diagrams for a 1,000 watt alternator which call for a field built up of disks of sheet iron with 8 internal poles. I cannot get punchings of this shape or size. Would several thicknesses of cast iron, ¼ inch thick, do? A. To use cast in place of wrought iron in a dynamo or motor will reduce the magnetic flux by about one-half. You would better make the sheets for field by hand than to sacrifice efficiency so much.

(7562) G. N. W. says: Please state a composition to coat the inside of tin cans to prevent the action of sulphuric and nitric acids on the tin. A. Use equal parts of gutta percha and paraffine melted together and used hot. The tin must be very clean and free from grease. Melt the gutta percha first over a water bath.

(7563) W. W. H. asks: 1. How far apart should condensing lenses in a magic lantern be placed relative to their foci? A. Place them nearly in contact. 2. Can acetylene gas be used for brazing, the same as other gas? A. We are not aware that such use has been made of acetylene.

(7564) F. W. B. says: I wish to be informed as to the process of bleaching tallow or making it white. A. In a copper boiler put ½ gal. water and 100 lb. rendered tallow; melt over a slow fire, and add, while stirring, 1 lb. of oil of vitriol, previously diluted with 12 lb. of water; afterward ½ lb. bichromate of potassa, in powder; and lastly, 13 pt. water, after which the fire is suffered to go down, when the tallow will collect on the surface of the dark green liquid, from which it is separated. It is then of a fine white, slightly greenish color, and possesses a considerable degree of hardness. Cleanliness is the great point in treating lard. The fat is freed from all adhering fleshy or discolored matter by cutting. It is then cut up into small pieces and washed until the water runs off clear. It is next melted by direct fire or steam coil until it becomes perfectly clear. It is run through close linen filters into the barrels, in which it is stirred until white and opaque, but only thickly fluid. The great point is when to cease stirring. It is then cooled and tightly covered. Air makes it rancid.

(7565) P. L. H. writes: I want to light one sitting-room with electric light means of a storage battery and primary batteries (chemical). Would you kindly inform me what type of storage battery and what kind of primary batteries you consider most suitable for such a purpose? I should like to have three or four lights of about 4 candle power or more if possible. A. The chloride accumulator is regarded as among the best forms of storage cells. To charge them by a primary battery is a slow process. Probably the gravity battery is the best for the work, since it is most constant in current. Salomon's "Management of Accumulators," price $1.50, gives much information on this subject.

(7566) P. A. M. writes: I have made the eight-light dynamo described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, and would like to know how much and what size German silver resistance wire to use for regulating purposes, it being shunt connected. A. The field regulator for dynamo of SUPPLEMENT 600 should contain 10 ohms resistance, or 200 feet of No. 16 A. W. G. German silver wire.

(7567) B. O. B. asks: 1. Electricity is generated by means of alternators at a power house—water power, for example. This electricity is to be conducted to a place about fifteen miles distant. Suppose it is generated with a pressure of 4,000 volts; would it be well to step it up to 11,000 or 12,000 volts? A. Yes. 2. Could wire be insulated and still carry such a high voltage, and, if it could not, would harm come to birds which came in contact with it? A. Insulated wire should be used, of course, but even then, no one should come in contact with the wire. It would be bad for the bird which should bridge a wire to the earth. 3. Where can I find any information in regard to the Keely motor? Can you give me the names of any scientific or engineering men who have seen said motor work? A. It is supposed that Mr. Keely took the secret of his motor with him when he died. We cannot tell where you can obtain information about it.

(7568) W. H. D. writes: 1. In SUPPLEMENT No. 641, in "How to Make a Simple Motor," by Hopkins, it says in one place to use No. 18 magnet wire on armature and in another place it says No. 16. Which is the wire to be used, and, if No. 18, how much is to be used? A. In SUPPLEMENT No. 641 the size of wire in armature is No. 18. In one place it is misprinted. 2. What size storage battery would it require to run two of these motors? A. Use the same number of cells storage battery as of bichromate. The size of cell is determined by the length of time you wish to run your motor.

(7569) F. S. G. asks: Can you inform me how many feet of No. 18 B. & S. gage iron wire it will take to make the core of an induction coil 10½ inches long by 1 inch in diameter? A. About 460 pieces of No. 18 B. & S. bare wire are required to form a round bundle 1 inch in diameter, if all the pieces are perfectly straight. This makes a little over 400 feet.

(7570) R. McK. asks: Please inform me what size German silver resistance wire to use in making a rheostat for six cells of Edison-Lalande battery, type Q, 3 amperes and 7 volts? A. The maximum current capacity of type Q, Edison-Lalande cells is given as 9·5 amperes. If you wish to use 3 amperes, you will require 1·4 ohms in the external circuit. This includes the resistance of the rheostat and the apparatus, whatever it may be that you are using. We cannot tell you definitely what to use without knowing what you wish to do; but you will be about right if you take 10 or 12 feet of No. 20 bare German silver wire for the rheostat.

(7571) J. H. C. asks for the best receipts and manner of tempering springs, such as gun springs, for main spring and such like. Also receipt for tempering mill picks. A. To Temper Steel Springs. Heat to an even red heat, rather low, to prevent cracking; quench in lukewarm water. Place in ladle with enough tallow to cover it; heat until tallow burns with a large flame extending beyond ladle, then set the ladle aside and allow it to cool.—To Temper a Revolver Spring. Heat the spring to a cherry red, and plunge in linseed oil. To draw the temper to the desired degree, hold the spring over the fire and allow the oil to burn away; take away from the fire, put on more oil, and let it burn away. Burn the oil off three times and plunge in the oil again. The spring is then ready for use. Do not overheat the steel. Test the temper frequently with a file.—To Temper a Small Spring. Heat the spring to a light red, plunge in cold water; hold the spring over the flame of a small fire of shavings until it becomes black, then hold in the fire until the black disappears. Cool the spring by swinging it in the air.—There is nothing peculiar in hardening mill picks, only that they should be as hard as possible and moderately tough. The greatest care should be taken to avoid burning the steel. Where there is much of this work to be done, the picks can be heated in a pot of cherry red hot lead, then dipped plumb into clear water at about 60 degrees. Do not draw the temper. The hardening by the ordinary smith's fire can be well done if charcoal is used and not hurried through the fire. Hurry burns the corners. Much also depends upon the shape of the pick, as to whether it is a sectional or leaf pick, or a thick, solid pick, the last being the most difficult to manage on account of the sharp edge and thick back. They should be laid across the fire so as to heat the eyes as fast as the edge.

(7572) J. S. asks: 1. At 104 volts, 7,200 amperes, how many amperes does the high tension transformer take in the Tesla-Thompson high frequency coil as described in SUPPLEMENT, No. 1085? Can I wind this transformer so as to take only 2 amperes and still use No. 31 wire on secondary coil and step up to 10,000 or 15,000 volts? A. We regret to say we have not the data for variations of the transformer and coil of SUPPLEMENT, No. 1085. Any other ratio of stepping up the voltage can be employed. It is simply the ratio of the number of turns in primary and secondary. The number of amperes which will flow is influenced largely by the self-induction of the turns of the primary. 2. Please give me dimensions for a static machine that will give an 18-inch or larger spark if possible. A. For static machines, see SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 548, 584, 647, 914, 948, price 10 cents each. For an 18-inch spark, you will require plates 36 inches to 40 inches in diameter. 3. Can the length of the spark be doubled by using a large condenser? A. The mere length of spark of a static machine is decreased by the addition of a condenser, but its intensity is increased.

(7573) G. L. asks: What effect will a shrill whistle or any ordinary noise have on a gas light? Will it cause any commotion to the flame in any way? A. A shrill whistle or other sharp sound will produce a strong vibration in a flame which is pitched so as to vibrate in unison with the sound. See Tyndall's "Sound," price $2.50, for much interesting information on sensitive flames.

(7574) Buffon writes: I see in the SCIENTIFIC AMERICAN the description of an oxide of copper battery. I would like to know if this battery is capable of furnishing light to say ten or more incandescent 16 candle power lamps. A. No primary battery of any kind can be used to light 16 candle power lamps with economy. The labor of caring for the battery and cost of materials is prohibitory. The entire time of an intelligent workman would be needed for your plant, and a new set of materials every few days, varying with the number of hours of use per day. We can safely say no such outfit is in existence.

(7575) C. F. W. asks: 1. What advantage have telephones with bridging bells over those with series bells? A. The inductance is greatly reduced by putting the bells in parallel with the line, or bridging them, as it is called. 2. How many instruments having 10,000 ohm generators and series bells can be used on one short line? A. We do not know what the practical limit is. 3. How many with bridging bells? A. More than thirty bridging bells have been worked successfully across one line. 4 Can series and bridging bells be used on the same line. A. To an extent they can be, but it would be very poor economy. 5. What should be the resistance of ringer coils in series with 10,000 ohm generator? A. Ordinarily about 100 ohms. 6. Of bridging coils? A. About 1,000 ohms. Webb's "Telephone Handbook," price $1, and Poole's "Practical Telephone Handbook," price $1.50, are indispensable to everyone engaged in telephone work.

TO INVENTORS.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

JANUARY 10, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Adjustable chair, D. E. Carter	617,638
Alarm. See Bicycle alarm. Fire alarm.	
Alcohol from aldehyde, purifying raw, C. Killing	617,460
Annunciator drop device, W. O. Meissner	617,[illegible]
Ash can, E. Nathan	617,44[illegible]
Automatic gate, C. M. Kortner	617,[illegible]
Automatic regulator, G. S. Neeley	617,598
Axle, P. Sharkey	617,[illegible]
Baling press, S. Hurt	617,531
Bandage machine, W. S. Ross	617,542
Bed, folding, J. Levy	617,586
Bell, bicycle, O. Price	617,602
Bicycle, L. B. Gaylor	617,329
Bicycle, W. L. Martin	617,535, 617,536
Bicycle alarm, J. M. Butcher	617,412, 617,413
Bicycle attachment, J. M. Gilbert	617,685
Bicycle coin controlled lock and holder, H. G. Shultz	617,693
Bicycle drive chains, protecting casing for, J. D. Farmer	617,683
Bicycle frame, J. A. Reed	617,604
Bicycle gear, W. Bowers	617,392
Bicycle gear, chainless, K. Brooks	617,635
Bicycle mud guard, R. A. M. Hermann	617,504
Bicycle or similar machine, J. A. Kelly	617,578
Bicycle propelling mechanism, G. F. Beebe	617,390
Bicycle propelling mechanism, W. J. Bosch	617,631
Bicycle saddle, M. J. O'Farrell	617,654
Bicycle support or rest, H. W. Roby	617,448
Bicycle valve, J. Harrison	617,337
Bit. See Driving and medical bit.	
Blind slat tenon, A. D. Miller	617,468
Blow overs, apparatus for removing, E. P. Gleason	617,333
Blow overs, device for removing, E. P. Gleason	617,334
Boat canopy, J. C. Harlow	617,571
Boiler. See Steam boiler.	
Boiler flue check, E. Hanstein	617,570
Boiler furnace, C. M. Day	617,521
Boiler supporting lug, G. H. Drake	617,524
Boiler tube cleaner, Forsyth & Bell	617,327, 617,439
Book, manifolding check, I. Moore	617,469
Boring and mortising machine, Parsley & Cottrell	617,473
Bottle, non-refillable, Hanlon & Reuber	617,395
Bottle washing apparatus, C. Kirschner	617,341
Bottles, etc., closure for preventing refilling of, A. A. Bhise	617,629
Box. See Match box. Paper box.	
Box fastener, R. C. Kuhn	617,582
Brake. See Car brake.	
Braking and feeding apparatus, C. M. Day	617,523
Bridge and locking device therefor, draw, W. L. Sampson	617,606
Bridge and wharf floor construction, J. G. McMillan	617,471
Broom spreader, F. C. Bowen	617,556
Brush, N. F. Carryl	617,316
Bulkhead doors, apparatus for closing or opening, A. W. Montgomery-Moore	617,593
Bulletin board, F. E. D'Humy	617,574
Burner. See Gas burner. Vapor burner.	
Bustle, Taylor & Hammond	617,452
Calendar, memorandum, E. A. Armstrong	617,387
Camp chair and cane, combination, U. Smith	617,661
Can. See Ash can.	
Can filling apparatus, oil, R. Dreyer	617,566
Cane and folding chair, combined, N. Christianson	617,641
Car brake, E. B. & A. L. Gesche	617,650
Car door, grain, W. M. Linvill	617,444
Car engine, reciprocating, McIntyre & Baltzley	617,470
Car grain door, railway, B. W. Davis	617,642
Car, hand, J. Milliron	617,344
Cars, portable horse stall for railway, J. P. Young	617,623
Carding apparatus, W. J. Donigan	617,481
Carpet stretcher and tacker, C. Gosemann	617,569
Cash register and indicator, E. B. Hess	617,485

© 1899 SCIENTIFIC AMERICAN, INC.

Casket handle, E. R. Sargent..... 617,360
Caster socket, F. C. Mason..... 617,467
Casting waste traps, mould for, P. D. Hay..... 617,396
Center indicator, C. P. Fay..... 617,501
Chafe iron, L. F. Fales..... 617,483
Chair. See Adjustable chair. Camp chair.
Chair and bed, combined. A. Nilson..... 617,348
Chip rack, S. A. Cohen..... 617,478
Churn, J. H. Folliott..... 617,502
Churn dasher, J. W. Click..... 617,461
Cigar machine, Snavely & Keller..... 617,366
Circuit breaker, P. R. Goldey..... 617,503
Cleaner. See Boiler tube cleaner.
Clock, alarm, A. C. Reichel..... 617,356
Clothes rack, J. C. Strickland..... 617,611
Clothes rack and closet, combined, E. Christen... 617,640
Clutch, friction, F. G. Hobart..... 617,419
Cock, ball, T. J. McHugh..... 617,597
Coffee, roasting, A. Brougier..... 617,434
Coin detector, J. Mason..... 617,421
Coloring matters, making indigo, K. Heumann... 617,652
Combing machine rollers, bearing for, Hoyle & Colburn..... 617,465
Computing machine, J. E. Duncan..... 617,323
Concrete, W. M. Robinson..... 617,427
Concrete arch, E. Thacher..... 617,615
Concrete mixer, W. M. Riley..... 617,425
Corner piece for knockdown structures, C. H. Boeck..... 617,698
Coupling. See Hose coupling. Thill coupling. Whiffletree coupling.
Cultivator, corn, T. L. Alexander..... 617,455
Cultivator, wheel, H. C. Young (reissue)..... 11,708
Curtain holding device, G. H. Davis..... 617,321
Curtain ring, J. W. Leslie..... 617,585
Cushion. See Stair cushion.
Cutter. See Twine cutter.
Cyanid filter tank, P. Argall..... 617,497
Cycle handle bar, J. W. Deans..... 617,565
Cycle handle bar, C. Ebling..... 617,500
Cycles, variable driving gear for, J. N. Carey..... 617,637
Damper, stove draught, J. H. Reed..... 617,354
Dental purposes, alloy for, C. A. R. Samsioe..... 617,359
Detector. See Coin detector.
Die barbs, machine for forming, E. Williams..... 617,622
Digger. See Potato digger.
Dish washing machine, Parry & Evans..... 617,599
Display stand joint, J. Kurz..... 617,342
Ditching machine, traction, Scearcy & Martin ... 617,697
Diver's belt, W. K. Crawford..... 617,675
Door check and closer, A. Damitz..... 617,479
Door hanger, W. F. Berry..... 617,553
Draught equalizer, G. Dopkins..... 617,644
Draught equalizer, C. K. Tveit..... 617,374
Drill. See Rock drill.
Driving and medical bit, combined, J. A. Lemons 617,583
Drying apparatus, F. Berner, Jr..... 617,391
Dye and making same, blue, Bernthsen & Jaubert..... 617,628
Dye and making same, blue, K. Heumann..... 617,651
Dye and making same, blue, M. H. Isler..... 617,686
Dye and making same, phosphin, Julius & Darier 617,340
Dye and making same, yellow basic disazo, F. Scholl..... 617,544
Dye, blue safranin, Uerfberg & Heimann..... 617,703
Dyes, making green, O. Bally..... 617,627
Eaves trough, Schwone & Lamper..... 617,658
Egg beater, W. R. Ellis..... 617,416
Electric device, D. Misell..... 617,592
Electric motors and railway trains, system of control for, W. B. Potter..... 617,601
Electric motors and trains, controlling, E. Thomson..... 617,546
Electric motors, automatic alarm mechanism for, R. W. Traylor..... 617,664
Electric signal, C. A. Parrish..... 617,540
Electric transformer, D. H. Wilson..... 617,381
Electrical cutout, A. P. Seymour..... 617,608
Electrical resistance, Voigt & Haeffner..... 617,375
Electrotherapeutic and massage apparatus, O. Schneider..... 617,543
Elevator. See Grain elevator.
Elevator cylinder alining device, G. H. Reynolds 617,357
Elevator safety device, J. Meyer..... 617,537
Engine. See Car engine. Explosive engine. Gas engine. Motive engine.
Engine having two or more cylinders, Weighton & Morison..... 617,620
Excavator, W. S. Russell..... 617,605
Explosive engine, E. E. Truscott..... 617,372
Explosion engine or motor, F. R. Simms..... 617,660
Extracts, apparatus for making fluid, J. F. Duke 617,322
Eyeglass guard, E. Eggert..... 617,676
Fan and pump, centrifugal, G. M. Capell..... 617,520
Fastener, separable, G. E. Adams..... 617,624
Feed reversing mechanism and stop motion, H. L. Flather..... 617,567
Feed water regulator, D. Almy..... 617,517
Fence stay, wire, R. B. Leatherman..... 617,442
Fence, wire, J. A. McDaniel..... 617,596
Filter, oil, W. D. Legg..... 617,343
Fire alarm, G. W. Fallin..... 617,326
Fire extinguisher system, automatic, C. G. Smith 617,365
Fire lighter, R. Pflaum..... 617,424
Flour from pumpkins, etc., making, L. McClatchey..... 617,423
Fly paste, apparatus for covering strings with, J. N. Wright..... 617,384
Forceps, E. G. Link..... 617,587
Forceps, pig, H. J. Totten..... 617,371
Fruit picker, W. Mussman..... 617,346
Furnace. See Boiler furnance. Hot air blower furnace. Smoke consuming furnace.
Furnace gases, apparatus for separating dust from blast, B. H. Thwaite..... 617,618
Furnaces, apparatus for preparing and feeding fuel to, C. M. Day..... 617,522
Furnaces, means for charging open hearth, H. Tomkins..... 617,663
Fusee, W. D. Jackson..... 617,576
Game apparatus, A. Clark..... 617,562
Gas apparatus, acetylene, E. Bournonville..... 617,632
Gas burner, incandescent, W. R. Clay..... 617,459
Gas burner support, incandescent, Clay & Walmsley..... 617,460
Gas engine, E. & W. F. Bauroth..... 617,388
Gas generating apparatus, acetylene, Chesnay & Pilllon..... 617,436
Gas generating apparatus, acetylene, J. Condon.. 617,563
Gas generator, acetylene, C. W. Beck..... 617,389
Gas generators, feed water regulator for acetylene, I. C. Curtis..... 617,320
Gas manufacturing apparatus, F. Egner..... 617,646
Gas producing apparatus, acetylene, A. H. Barthez..... 617,518
Gate. See Automatic gate. Mine gate.
Gate, J. F. Pifer..... 617,494
Generator. See Gas generator. Steam or hot water generator.
Generator, J. O. Morris..... 617,594
Glass annealing and purifying furnace, J. D. Neipling..... 617,690
Glass, metals, etc., means for grinding or polishing, W. O. Bailey..... 617,658
Grain dislodging device, H. E. Koch..... 617,488
Grain elevator, W. P. Wright..... 617,385
Grain separator, B. Holt..... 617,486
Grinding mill, J. E. Mitchell..... 617,345
Guns, breech mechanism for quick firing, E. Ternstrom..... 617,614
Hame and trace connection, J. J. Creedon..... 617,498
Hammock support, S. Williams..... 617,475
Handle. See Casket handle.
Hanger. See Door hanger. Lamp hanger.
Harp, R. Robbins..... 617,514
Harrow, rotary disk, A. V. Wilbur..... 617,378
Harvesting machine, knotter, J. F. Steward..... 617,545
Hat sizing machine, J. L. Canham..... 617,519
Headlight lamp, electric, H. P. Wellman..... 617,621
Heater. See Tank heater.
Heliograph, J. P. Friez..... 617,684
Hoisting apparatus, W. Williamson..... 617,380
Horseshoe, elastic tread, Crozier & Smith..... 617,319
Hose coupling, Miller & Christman..... 617,591
Hot air blower furnace, H. Baetz..... 617,432
Hotel register, J. F. Drury..... 617,645
Incubator, C. S. Wilson..... 617,547
Indicator. See Center indicator.
Ink, F. B. Canode..... 617,315
Joint. See Display stand joint.
Journal bearing, J. Appel..... 617,550
Kinetoscone, W. B. Davis..... 617,643
Knife adjuster, M. M. Whipple, 2d..... 617,666
Lamp chimney, F. Dunham..... 617,394
Lamp hanger, L. L. Powell..... 617,351
Lamp socket for street service, W. E. Holmes.... 617,464
Lawn sprinkler, A. L. Lambert..... 617,688
Leather staking machine, C. F. Stackpole..... 617,368
Liquid distributing device, J. O. Reed..... 617,355
Lock. See Sash lock. Seal lock.
Lock, S. Shaw..... 617,361
Lock and latch combined, Fergusson & Chase.... 617,648
Locomotive, C. A. Couch..... 617,564
Loom shuttle guard, M. T. Melvin..... 617,590
Lubricator, W. H. Bigelow..... 617,554
Mat, A. S. Allen..... 617,625
Match box, pocket, E. H. Eastwood..... 617,525
Match machine, E. H. & W. G. Bronson..... 617,634
Measuring instrument, electrical, Hanchett & Sage..... 617,418
Mechanical movement and bicycle gear, N. & R. Rapp, Jr..... 617,447
Medical shelf and indicator, H. M. Minnis..... 617,689
Mercerizing machine, H. W. Butterworth..... 617,561
Merry-go-round, P. J. Spracklen..... 617,609
Metal planer, C. A. Juengst..... 617,532
Metal planing tool, W. H. Chappell..... 617,670
Metal turning machine, F. Schulze..... 617,408
Metals, apparatus for electrodeposition of, E. Emerson..... 617,526
Metallic articles, restoring worn rolled or drawn, G. S. Merrill..... 617,422
Mill. See Grinding mill.
Mine gate, N. K. Bowman..... 617,699
Mirror, hand, C. E. Allen..... 617,626
Mixer. See Concrete mixer.
Motive engine, A. Howard..... 617,529
Motor. See Electric motor.
Mower, lawn, T. Coldwell..... 617,671
Mower, lawn, W. P. Leshure..... 617,584
Music holder, F. C. Luethi..... 617,588
Music leaf turner, A. E. Smith..... 617,364
Nozzle, water, Neumeyer & Young..... 617,472
Nut lock, J. W. B. Cook..... 617,672
Oil and making same, synthetic violet, P. Barbier..... 617,552
Oil from nuts, extracting, T. C. Graham et al..... 617,653
Oven, portable knockdown, C. H. Boeck..... 617,696
Paint drum, keg, tin, etc., E. S. Pinchin..... 617,406
Paper box, G. A. Bisler..... 617,457
Paper fastener, T. F. Welch..... 617,453
Paper vessel, W. M. Kinnard..... 617,401
Paper, wire netting for use in manufacturing, K. Kufferath..... 617,581
Pen ink holder, T. Quinlan..... 617,541
Photographic plate washer, F. R. Hall..... 617,335
Pianoforte action, E. L. Willeford..... 617,411
Picker. See Fruit picker.
Pistol for squirting liquids, G. Reimann..... 617,495
Pivot, mirror or transom, C. D. Norton..... 617,349
Plant setter, J. H. Masters..... 617,403
Planter, C. C. & L. S. Caves..... 617,639
Plaster metallic support, T. M. Clancy..... 617,458
Plastic material, machine for shaping, G. Stoff... 617,610
Plow, gang, A. V. Wilbur..... 617,377, 617,379
Plow, riding, E. M. Heylman..... 617,338
Pneumatic dispatch apparatus, A. J. Gillespie.... 617,417
Pocket watch guard, J. S. Coyte..... 617,674
Potato digger, B. A. Reynolds..... 617,513
Power, direct conversion of energy of fuel and an expansion medium into, Howard & Green 617,530
Precious metals from ores, apparatus for extracting, L. E. Porter..... 617,512
Precious metals from their ores, apparatus for separating, J. R. Macmaster..... 617,466
Press. See Baling press.
Printing, checking, and issuing railway or other tickets, machine for, E. M. Bossuet..... 617,313
Printing press feeder, J. F. McNutt..... 617,404
Printing press sheet adjuster, C. P. Babcock..... 617,456
Propelier, adjustable, E. E. Truscott..... 617,373
Propeller, screw, A. Howard..... 617,527
Pulverizing machine, soil, J. C. Tate..... 617,613
Pump support, portable hand, J. Rieg..... 617,358
Pumps, equalizer for windmill operated, J. Willmann..... 617,496
Punch and shears, L. Van Dorin..... 617,619
Push rod, B. Haskell..... 617,484
Puzzle, F. A. Worden..... 617,549
Pyrotechnic signal, H. J. Pain..... 617,539
Pyroxylin composition, J. H. Stevens..... 617,450
Rack. See Chip rack. Clothes rack.
Rail joint nut lock, Kinsey & Young..... 617,579
Railway cattle guard, Newell & Sullivan..... 617,347
Railway curve sweeper and oiler, street, G. Huff. 617,420
Railway rolling stock, double action coupling attachment for, J. Purser..... 617,446
Railway signal, J. W. Jones..... 617,507
Railway signal fusee, H. M. Warner..... 617,376
Railway signal system, F. C. Esmond..... 617,325
Railway tie, metallic, G. A. Penrose et al..... 617,600
Recorder. See Salary recorder.
Recording apparatus, R. Macrae..... 617,534
Reel, H. Casler..... 617,435
Register. See Cash register. Hotel register.
Regulator. See Automatic regulator. Feed water regulator.
Repair tool, R. L. Johnstone..... 617,398
Ring. See Curtain ring.
Rock drill, A. Rosenholz..... 617,407
Rocking article, G. F. Drew..... 617,438
Rolling metal, construction of rolls for, Stiefel & Trethewey..... 617,409
Rolling metal tubes, machine for, G. Skogse..... 617,363
Rolling mill feed table, F. I. Freeman..... 617,328
Roving machine, W. C. Peirce..... 617,511
Salary recorder, A. R. Boynton..... 617,557
Salt cellar, C. Lawton..... 617,490
Sand shoveler, J. E. Johnson, Jr..... 617,506
Sash fastener, W. H. Blakemore..... 617,669
Sash fastener, F. L. Keith..... 617,399
Sash holder, A. T. Johnson..... 617,339
Sash lock, H. Bliss..... 617,630
Sash lock, W. P. Gelabert..... 617,330
Sash, window, J. R. Engqvst..... 617,482
Saw, scroll, A. Jones..... 617,440
Saw set, J. H. Stuke..... 617,612
Scraper, wheel, W. P. Warren..... 617,430
Screw anchor, W. Love..... 617,492
Seal, car, C. F. Roberg..... 617,426
Seal lock, A. W. Coffin..... 617,477
Seed drill attachment, W. P. Whittier..... 617,454
Seeding machine, A. Lindgren..... 617,443
Separator. See Grain separator. Steam separator.
Sharpener, band cutter knife, J. E. Crowley..... 617,318
Sheet metal plates, apparatus for cleaning and coating, C. C. Roberts..... 617,656
Shoe, A. Goldberg..... 617,701
Shoe stretcher, G. E. Belcher..... 617,312
Shutter fastener, H. M. Wilson..... 617,548
Signal. See Electric signal. Pyrotechnic signal. Railway signal.
Siphon head, J. Ormerod..... 617,655
Skate, ice, C. F. Filor..... 617,649
Smoke consuming furnace, W. Lutz..... 617,533
Sodium bicarbonate, apparatus for drying, E. Solvay..... 617,367
Soot destroyer, composition of matter for a, D. M. Brubaker..... 617,700
Sounding apparatus for navigators' use, Tanner & Blish..... 617,451
Spacing mechanism, J. S. Bancroft..... 617,551
Spectacle attachment for eyeglasses, J. J. Mundorff..... 617,595
Speed gearing, changeable, J. W. Eisenhuth..... 617,647
Spindle step, roller bearing, T. J. Tellefsen..... 617,370
Spinning and twisting machinery, A. D. Emery.. 617,677
Spinning apparatus, progressive, A. D. Emery.... 617,680
Spinning head, A. D. Emery..... 617,678, 617,681
Spinning machinery, A. D. Emery..... 617,679
Spinning mechanism, A. D. Emery..... 617,682
Sprinkler. See Lawn sprinkler.
Stacker, pneumatic straw, W. J. & A. C. Randolph..... 617,352
Stair cushion, P. K. Saponoff..... 617,449
Steam boiler, horizontal tubular, E. Kendall..... 617,510
Steam boiler, vertical tubular, E. Kendall..... 617,509
Steam or hot water generator, J. L. Chapman..... 617,393
Steam separator and grease extractor, J. J. J. De Rycke..... 617,480
Steam trap, J. B. Morgan..... 617,498
Stool or chair, automatically locking, H. Earl, Jr. 617,324
Stove, combined gas and fuel, C. D. Shepard..... 617,362
Stove feeding attachment, oil, C. H. Boeck..... 617,697
Stove, oil, C. H. Boeck..... 617,695
Stove or furnace, F. Robinson..... 617,657
Stove, vapor, C. H. Boeck..... 617,694
Sugar or salt shaker, C. Lawton..... 617,489
Surgical dressing, sterilized, D. Smith..... 617,474
Table. See Wall table.
Tank. See Cyanid filter tank.
Tank heater, E. Sprankle..... 617,428
Tank planer and scraper, C. H. Hansen..... 617,336
Telephone, T. Berdell..... 617,433
Telephone, W. E. Byrns..... 617,314
Telephone switchboard, J. M. Overshiner, 617,691, 617,692
Telephone system, D. H. Wilson..... 617,382
Tellurian, J. E. Lyons..... 617,589
Tension device, P. E. Spickler..... 617,516
Thill coupling, C. C. Bradley..... 617,558, 617,559
Thorium oxides, obtaining, W. Buddeus..... 617,636
Threshing machine, D. S. Long..... 617,402
Threshold, automatic, C. R. Sowden..... 617,662
Tie. See Railway tie.
Time recording and checking apparatus, workman's, W. Whitehead..... 617,410
Tire, H. B. Hollifield..... 617,505
Tire tightener, J. Keepers..... 617,508
Toaster, broiler, etc., F. J. Keller..... 617,487
Tool, H. Kelly..... 617,441
Tool, combination, W. W. Davis..... 617,462
Tool holder, E. Hughes..... 617,573
Toy, E. P. Waterhouse..... 617,665
Trace connection, J. J. Creedon..... 617,499
Track suspending device, W. Louden..... 617,491
Trap. See Steam trap.
Trap, O. Thornley..... 617,617
Trestle, mechanics, H. S. Dotts..... 617,463
Trough. See Eaves trough.
Truck, car, F. G. Koehler (reissue)..... 11,709
Twine cutter for counters, etc., packing, M. T. Shine..... 617,515
Typewriting and adding machine, W. L. Bundy.. 617,560
Typewriting machine attachment, T. Oliver..... 617,350
Umbrella, ventilated, M. A. Eatman..... 617,415
Valve, J. & W. R. Thomas..... 617,616
Valve gear, J. H. Woods..... 617,383
Valve gear, engine, A. Howard..... 617,528
Valve, hydraulic, F. Wolfenden..... 615,667
Valve, rotary steam, R. Gillette..... 617,331

(Continued on page 47)

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

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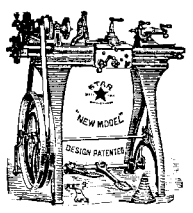

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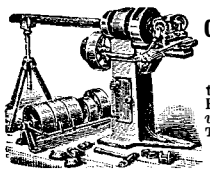

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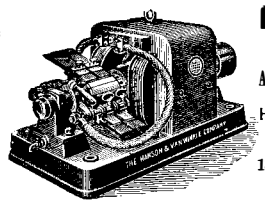

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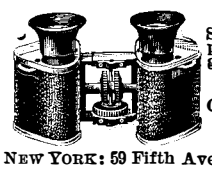

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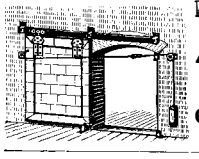

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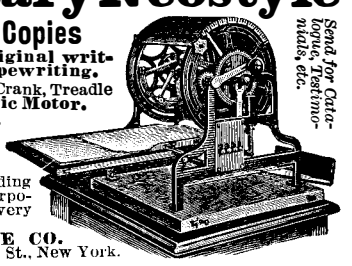

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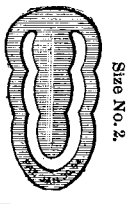

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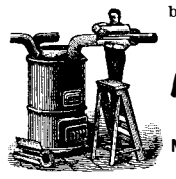

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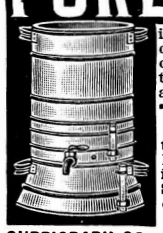

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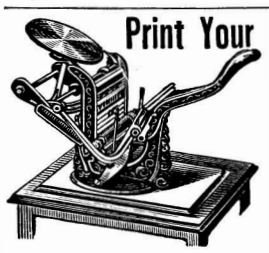

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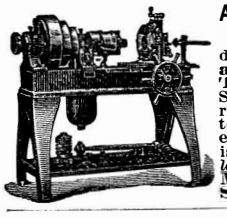

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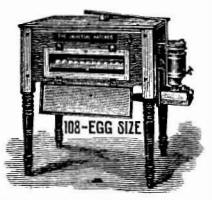

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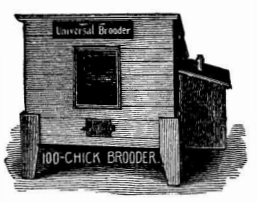

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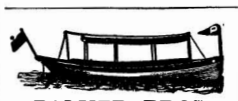

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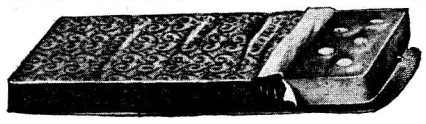

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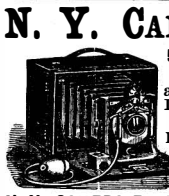

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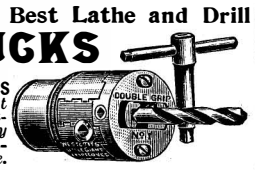

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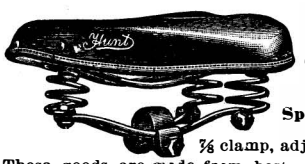

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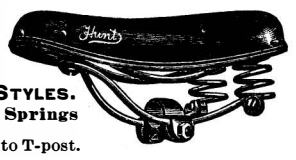

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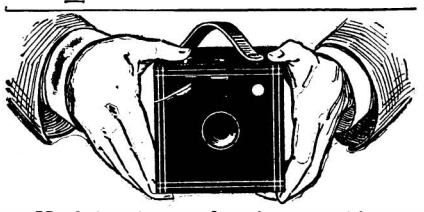

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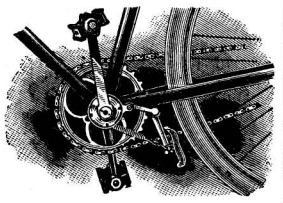

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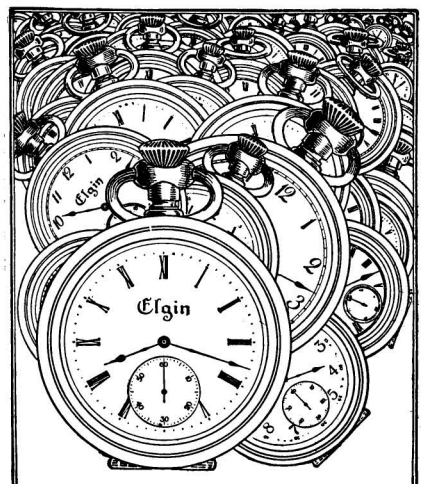

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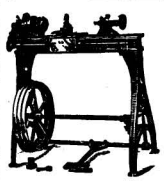

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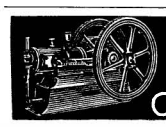

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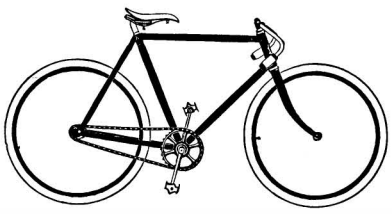

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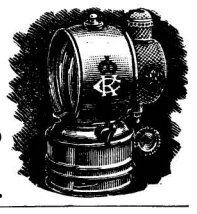

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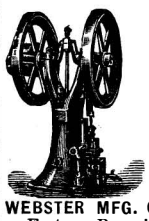

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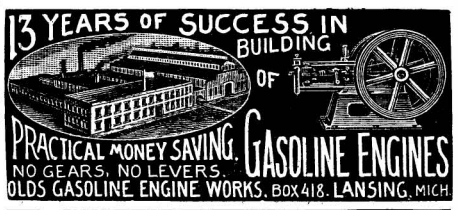
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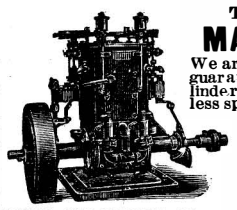

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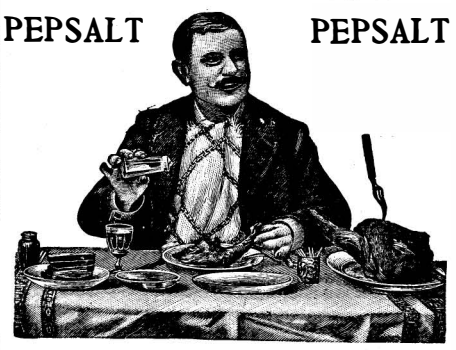

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